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INDUSTRIAL ARTS AND VOCATIONAL EDUCATION

THE SHOP TEACHERS' PROFESSIONAL MAGAZINE

SCHOOL SHOP ANNUAL

From black coal mixed with air and water, married by a "chemical parson," come the clear white crystals of nylon from which will be made more modern necessities, conveniences and luxuries when peace comes again to this world.

Photo courtesy
E. I. Du Pont de Nemours & Co., Inc.

SNOW WHITE from coal black

...but only if you handle it right

Far down beneath the fact that nylon will have a thousand peacetime uses . . . that nylon the wonder stuff has as one of its ancestors dirty, grimy coal . . . far below the fact of a hundred kindred man-made wonders, there is *another* fact of tremendous significance for all who are concerned to build a better world. That fact is this: all these miracles *do* make use of and can *only* make use of commonplace materials . . . and furthermore, it requires only the right handling and the right *catalyst* to produce them.

Fortunately for the future of our country, this is as true of mankind as it is of raw materials. Leaders in science, great engineers, captains of industry are not made of special stuff distributed by chance or heritage. They too are built of common clay. What happened in *their* case was that a *catalyst* was introduced . . . some influence brought to bear upon them during their formative years which gave them an entirely different picture of life and the part they could play in it.

Such catalysts are of many kinds. Intelligent instructors in mechanical drafting know that carefully chosen drawing instruments can be the liberating influence. They can be a spur and a lure to the interest that brought the boy to class; like a flash of lightning that illuminates the dark for a brief brilliant instant, they can lift a lad's imagination out of t hum-drum and give him a glimpse of u dreamed-of possibilities. In ways too subtle state, they encourage, strengthen and fos his belief in himself. Just as the gift of a fi baseball bat or baseball glove makes a youn ster see himself as a future great in baseball, fine drafting instruments are a constant sti ulus to that inner vision which more and mo absorbs the student's thoughts and takes po session of his actions. The results are so fa reaching in their implications that to co promise with quality may well turn out to a compromise with the future.

EUGENE DIETZGEN CO.

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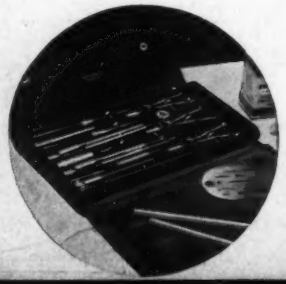

Army-Navy "E" Production Award for Excellence in Manufacturing, Drafting and Surveying Instruments and Supplies for the Armed Services of the United States.

ARMY E NAVY

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EVERYTHING FOR DRAFTING AND SURVEYIN

THE WINNER HAS CHANGED HIS APPEARANCE, TOO

Quality Comes FIRST

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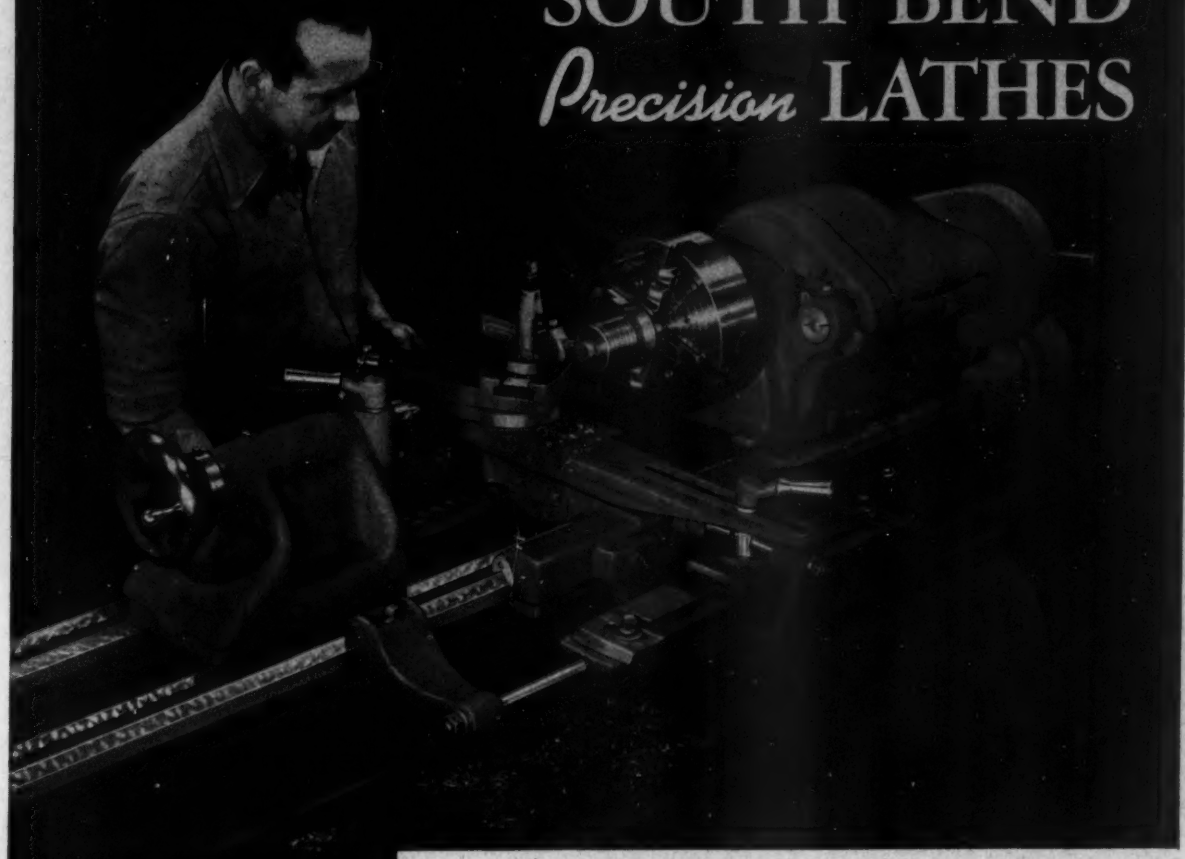
HAMMERS • HATCHETS • AXES • SLEDGES

SOUTH BEND *Precision* LATHES



SOUTH BEND 14½" TOOLROOM LATHE

SOUTH BEND 16" TOOLROOM LATHE

Pre-employment training must be both thorough and practical. To give trainees a partial knowledge of the work for which they are training is inadequate. In addition to acquiring basic skills, they need the experience of operating production equipment.

South Bend Lathes provide this type of training because they are so widely used in the war production industries. Their versatility, ease of operation, and accuracy facilitate teaching.

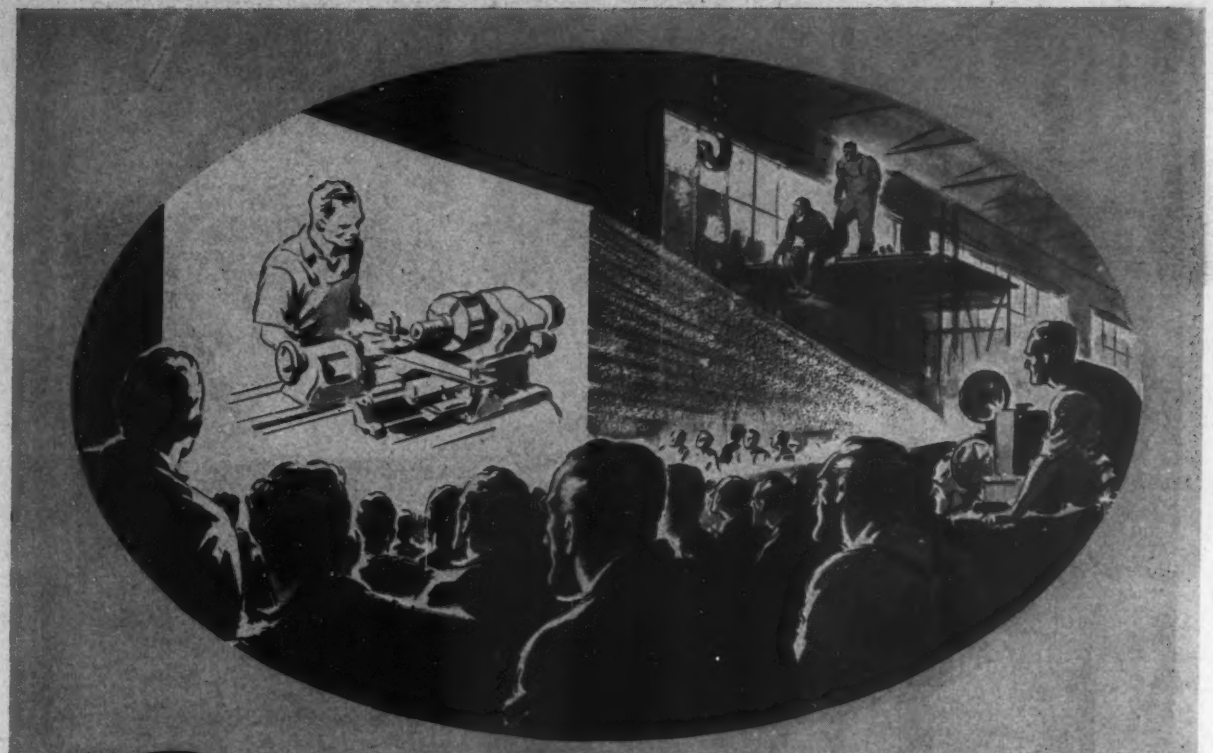
The range of sizes and types in which South Bend Lathes are available meet practically every school shop requirement. The Engine Lathes and Toolroom Lathes are made in five sizes, from 9" to 16" swings, and the Turret Lathes with 9" and 10" swings. A copy of Catalog 100-C describing these lathes will be sent upon request.

SOUTH BEND 13" ENGINE LATHE

SOUTH BEND 10" TOOLROOM LATHE

SOUTH BEND 9" BENCH LATHE

INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, March, 1944, Volume 33, No. 3. Published monthly, except during July and August, by The Bruce Publishing Co., Milwaukee 1, Wis. Entered January 2, 1914, as Second-Class Matter at Milwaukee 1, Wis., under Act of March 3, 1879. Subscriptions — U. S., $2.50 per year. Canada and Foreign, $3.00. Single copies, 35 cents.



Speed the Training OF NEW LATHE OPERATORS

Skilled manpower is one of the most critical of all war industry problems today. To replace the thousands of skilled machinists called to the services, new and inexperienced men and women workers must be trained to carry on the battle of production.

To help with the training of new lathe operators, South Bend offers a complete training program of sound films, reference books, manuals, wall charts, and bulletins. These represent an authoritative and effective course in lathe operation and modern shop practice. The 16 mm color, sound films have been adapted from South Bend's well known reference and text book, "How to Run a Lathe," now in its 42nd edition.

We are pleased to offer these films and instructional literature to industries and schools conducting pre-employment training classes.

WRITE FOR INFORMATION ON THESE PRACTICAL TRAINING HELPS

MOTION PICTURES—
"The Lathe" and "Plain Turning"—two 16 mm sound films in color on lathe operation. Available on a free loan basis for apprentice training. Showing time 20 minutes each. Write for Circular No. 8-A.

HOW TO GET THE MOST OUT OF YOUR LATHE—
Specialized service bulletins on the care and operation of engine lathes. H-1, "Keep Your Lathe Clean"; H-2, "Oiling the Lathe"; H-3, "Installing and Leveling the Lathe"; H-4, "Keep Your Lathe in Trim." Sample copies mailed on request.

HOW TO RUN A LATHE—
A practical 128-page operator's handbook. 360 illustrations. Written in simple and non-technical style. Used as a machine shop text book by the Army, Navy and Air Corps. Price 25c. Sample copy free to shop instructors.

THREAD CUTTING—
21-page book, "How to Cut Screw Threads in the Lathe." Shows how to set up a lathe for cutting various pitches of screw threads, setting cutter bits, screw thread formulae, metric threads, etc. Price 10c. Sample copy free to shop instructors.

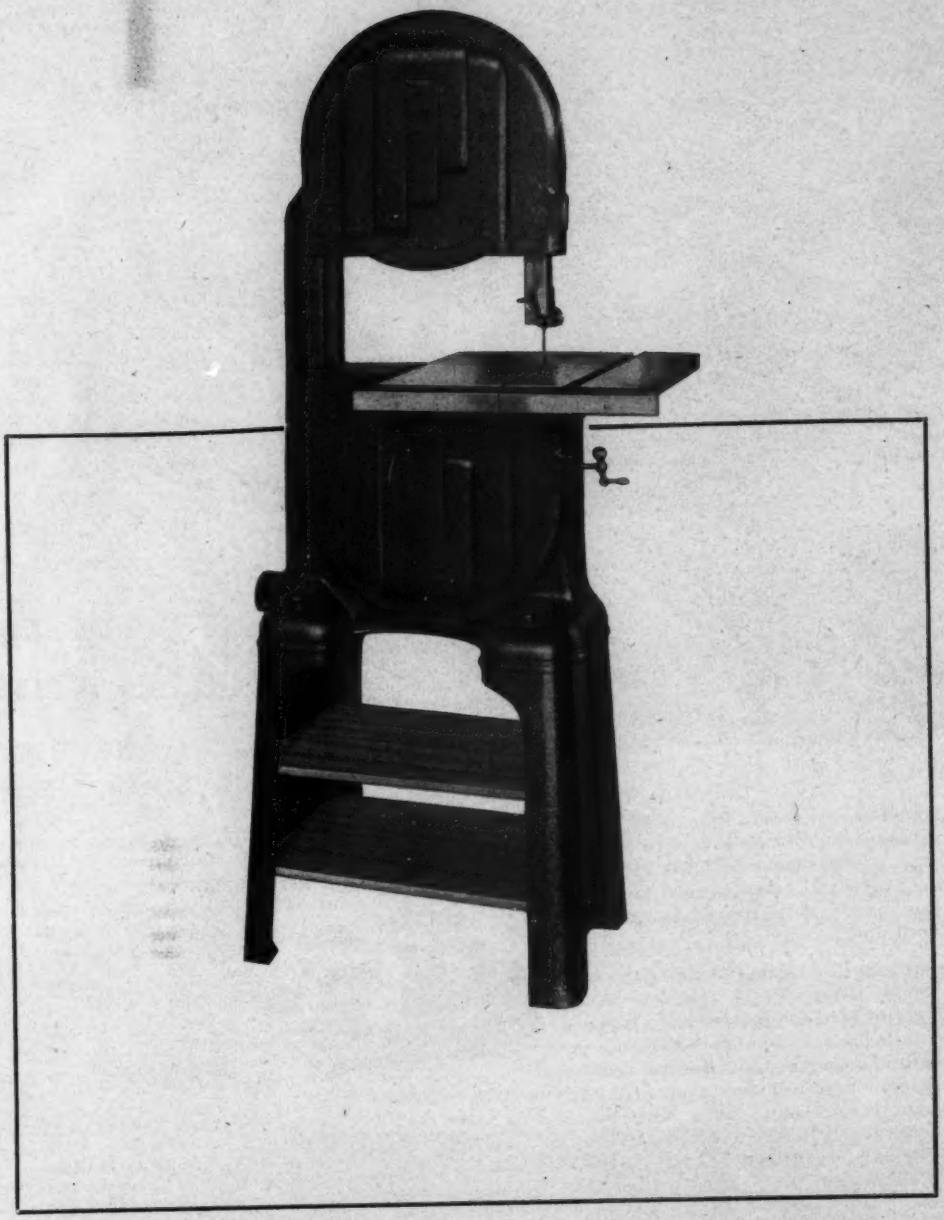
GRINDING CUTTER BITS—
12-page book on grinding lathe tool cutter bits. Covers identification and application of various bits, methods of grinding, correct angles, etc. Price 10c. Sample copy free to shop instructors.

ARMY E NAVY

BUY WAR BONDS!

SOUTH BEND LATHE WORKS • Lathe Builders for 37 Years • South Bend 22, Ind.

There Is No Substitute



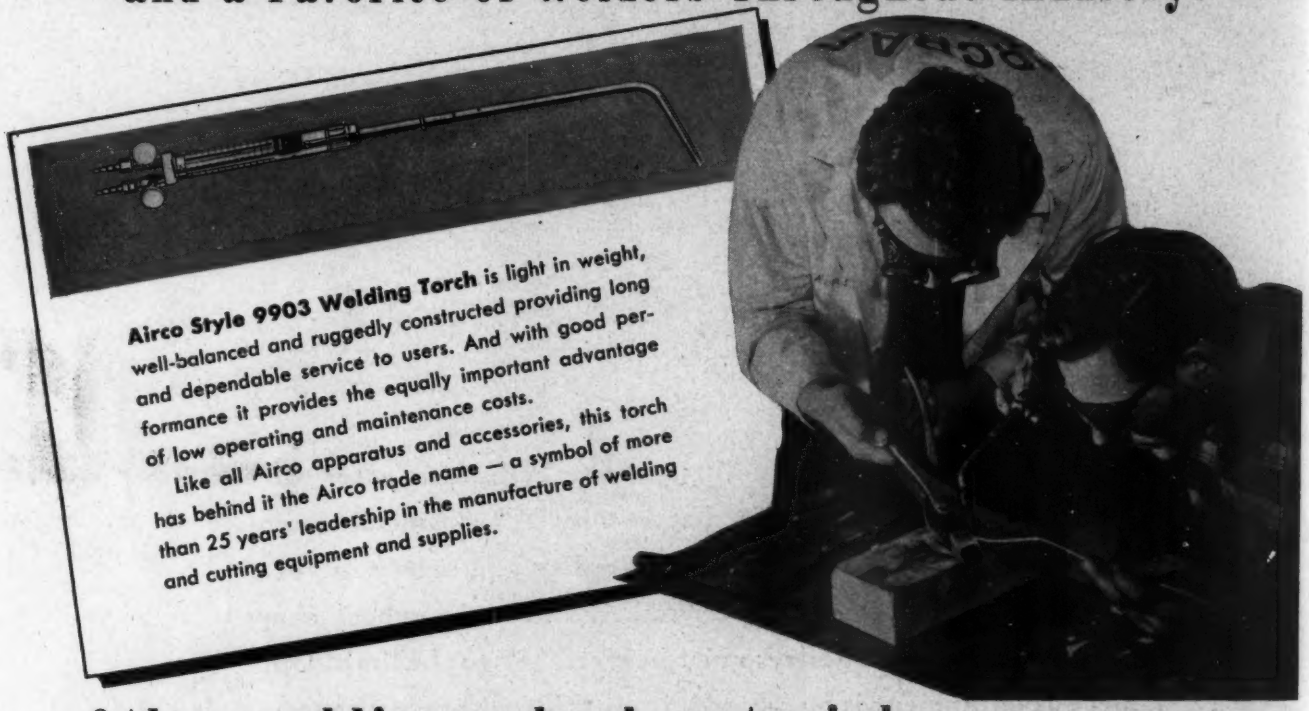
YATES-AMERICAN

for QUALITY . . .

It has often been said that quality is remembered long after price has been forgotten. Perhaps that is why Yates-American machines have become the standard of quality and safety in vocational education programs everywhere. For in school shops especially, equipment dollars must be stretched to the limit. Once a piece of equipment is purchased, it must last for many years — under the most severe operating conditions. Under today's vastly accellerated training programs quality is taking on added importance, for with school shop machines being virtually irreplaceable under existing priority regulations and delivery requirements, the success or failure of training courses depends in a large measure upon equipment that keeps running without costly, irritating breakdowns. Those instructors fortunate enough to have shops equipped with Yates-American woodworking machines are daily having demonstrated to them that "There Is No Substitute For Quality." Yates-American Machine Company, Beloit, Wisconsin.

YATES-AMERICAN

A popular torch among welding schools
and a Favorite of Welders Throughout Industry!



Airco Style 9903 Welding Torch is light in weight, well-balanced and ruggedly constructed providing long and dependable service to users. And with good performance it provides the equally important advantage of low operating and maintenance costs.

Like all Airco apparatus and accessories, this torch has behind it the Airco trade name — a symbol of more than 25 years' leadership in the manufacture of welding and cutting equipment and supplies.

Other welding school material

Whether it is oxygen, acetylene, tips, regulators, gas welding rods, hose, goggles, etc. for gas welding and cutting — or arc welding machines, electrodes, holders, cable, helmets, etc. for arc welding—your needs can be filled by Airco from its complete line of oxyacetylene and arc equipment.

As part of its service to welding schools, Airco makes available fifteen helpful wall charts showing cross-sectional views of welding equipment, and five *authoritative instruction manuals* written in clear, easily-understood language by experienced representatives of Airco's Applied Engineering Field Service. The charts are furnished gratis but the textbooks are reasonably priced with discounts applying to purchases totalling more than ten copies.

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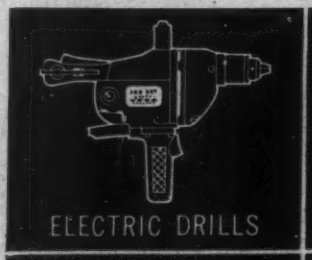

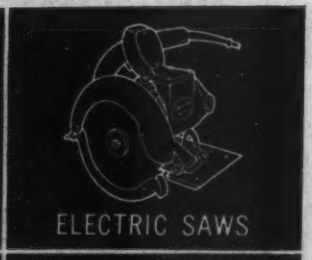

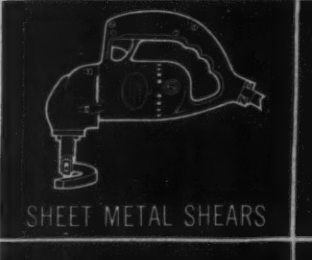

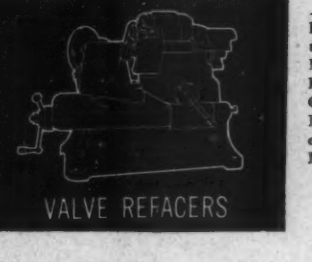

PICTURED on this page are a dozen "samples" of Black & Decker Portable Electric Tools—which give you only a small idea of the many hand operations which can be performed faster and better with the RIGHT tool for the job. The complete Black & Decker line contains more than a hundred electric tools—of many types, models, capacities and uses—all engineered to increase the skill and earning power of the user.

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For a copy of the new 1944 Black & Decker Catalog, drop a line today to: The Black & Decker Mfg. Co., 780 Pennsylvania Ave., Towson-4, Md. And remember: There's a Black & Decker Distributor near you as a ready source of information and supply. He'll be glad to serve you.

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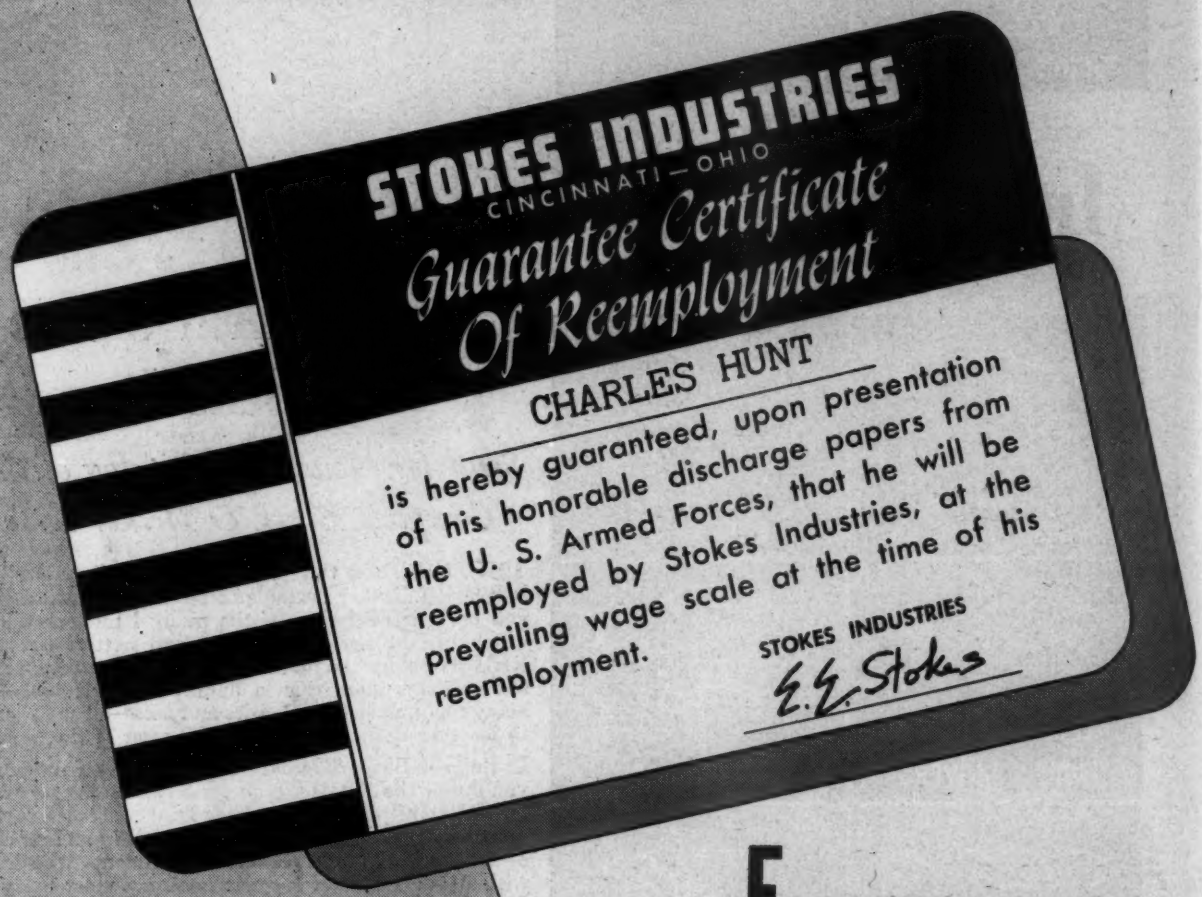
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is hereby guaranteed, upon presentation of his honorable discharge papers from the U. S. Armed Forces, that he will be reemployed by Stokes Industries, at the prevailing wage scale at the time of his reemployment.
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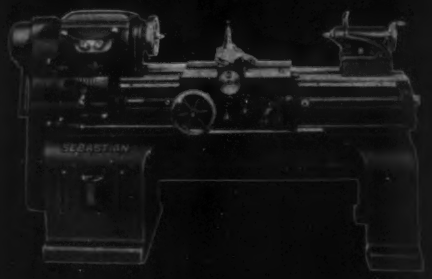
"Best Lathe In The Medium Price Field"



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FOR EVERY PURPOSE

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Awarded April 8th, 1943
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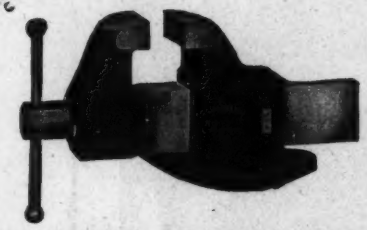
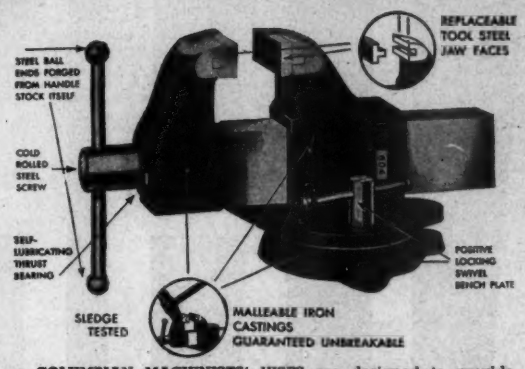
COLUMBIAN MACHINISTS' VISES




REPLACEABLE TOOL STEEL JAW FACES
STEEL BALL ENDS FORGED FROM HANDLE STOCK ITSELF
COLD ROLLED STEEL SCREW
SELF-LUBRICATING THRUST BEARING
POSITIVE LOCKING SWIVEL BENCH PLATE
SLEDGE TESTED
MALLEABLE IRON CASTINGS GUARANTEED UNBREAKABLE

• STATIONARY BASE VISES are machined flat and can be mounted without cutting the bench.

Stationary Base Machinists' Vises

Vise No.	Width Jaws	Jaws Open	Weight Pounds
503	3	4½	20
503½	3½	5½	29
504	4	6	36
504½	4½	7	47
505	5	8	58
506	6	10	90

• COLUMBIAN MACHINISTS' VISES are designed to provide accurate and dependable equipment for school and industrial shops.

T SECTION JAW FACES of hardened tool steel are pinned into the castings so they cannot come loose in use, but may be replaced if chipped or worn.

MALLEABLE IRON CASTINGS, an exclusive Columbian Machinists' Vise feature, provide increased working strength and are absolutely guaranteed unbreakable.

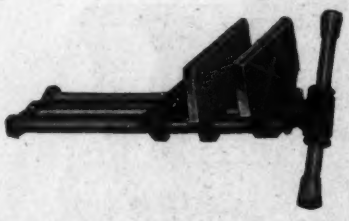
STEEL SCREW and MALLEABLE IRON NUT are designed for heavy duty. Hardened steel washer under the screw head prevents wear on front jaw casting.

• SWIVEL BASE VISES are positively locked by a forged steel lock bolt, designed with teeth which are drawn into gear-like corrugations in the base plate.

Swivel Base Machinists' Vises

Vise No.	Width Jaws	Jaws Open	Weight Pounds
603	3	4½	25
603½	3½	5½	34
604	4	6	42
604½	4½	7	55
605	5	8	70
606	6	10	106

COLUMBIAN WOODWORKERS' VISES

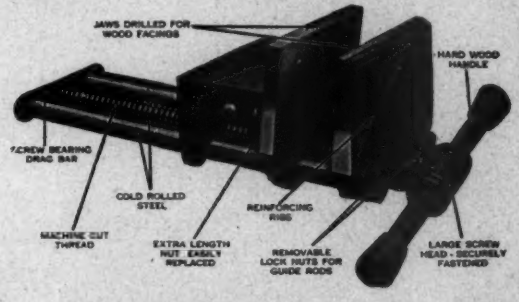


Rapid Acting Woodworkers' Vises

• Simple rapid acting mechanism consists a bronze half-nut operating in the groove p duced by milling off a section of each thre for the length of the screw. A slight turn the handle engages the threads of the nut a screw, and a half turn tightens the vise the work.

MADE IN ALL POPULAR SIZES

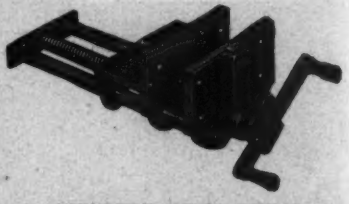
Rapid Acting Woodworkers' Vises	Plain Front Jaw		Dog in Front Jaw	
Vise No.	1R	9R	1RD	9RD
Jaw Size, in.	4x7	4x10	4x7	4x10
Jaws Open, in.	9	12	9	12
Weight, lbs.	24	32	25	33


JAWS DRILLED FOR WOOD FACINGS
HARD WOOD HANDLE
SCREW BEARING DRAG BAR
COLD ROLLED STEEL
REINFORCING RIBS
MACHINE CUT THREAD
EXTRA LENGTH NUT EASILY REPLACED
REMOVABLE LOCK NUTS FOR GUIDE RODS
LARGE SCREW HEAD - SECURELY FASTENED

Continuous Screw Woodworkers' Vises

• Extra heavy steel screw with carefully cut double threads operates in a solid malleable iron self-centering nut and insures positive fast action. Cold rolled steel guide rods, with drag bar as screw bearing, insure alignment and accuracy.

Continuous Screw Wood Handle Vises	Plain Front Jaw		Dog in Front Jaw	
Vise No.	5C	3C	5CD	3CD
Jaw Size, in.	4x7	4x10	4x7	4x10
Jaws Open, in.	9	12	9	12
Weight, lbs.	22	30	23	31



• ADJUSTABLE STEEL HANDLE increases speed of operation. With the handle centered at the screw head, the shortened radius permits quick adjustment of opening. By extending the handle, extra leverage is obtained to tighten the vise.

Continuous Screw Steel Handle Vises	Plain Front Jaw		Dog in Front Jaw	
Vise No.	5C-S	3C-S	5CD-S	3CD-S
Jaw Size, in.	4x7	4x10	4x7	4x10
Jaws Open, in.	9	12	9	12
Weight, lbs.	24	32	25	33

The Columbian Line also includes Combination Pipe Vises, Hinged Pipe Vises, Homeshop Vises, Blacksmiths' Leg Vises, Bench Anvils, and "C" Clamps.

THE COLUMBIAN VISE & MFG. CO.

9017 Bessemer Avenue Cleveland, Ohio

WORLD'S LARGEST MAKERS OF VISES

Atlas MACHINE TOOLS
★ FOR THE GREAT POSTWAR CHALLENGE TO VOCATIONAL EDUCATION

MORE and better training — for students to fill peacetime industrial jobs . . . for rehabilitation of servicemen . . . for the millions who'll follow machine tool hobbies — that's the postwar challenge to vocational education!

Atlas Machine Tools can help you solve this problem by giving more training per student per invested dollar. The Atlas favorites shown below provide equipment for precision training in every modern machining operation — at a cost that is only a fraction of that for unnecessarily large machines performing the same operations.

Get acquainted with Atlas tools now . . . send for catalogs and the name of our nearest distributor.

ATLAS PRESS CO.
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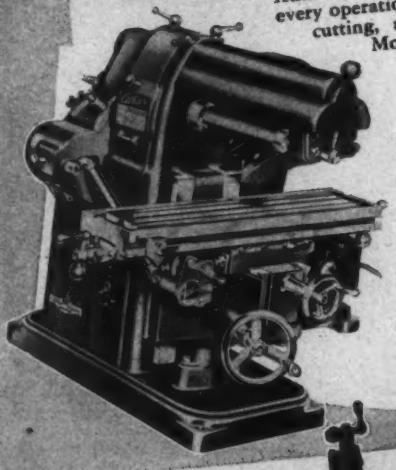
Atlas 10" LATHE

Atlas lathes offer training experience in every operation of the backgeared screw-cutting, automatic cross-feed lathe. Modern design for maintained precision and long life.

Atlas DRILL PRESS

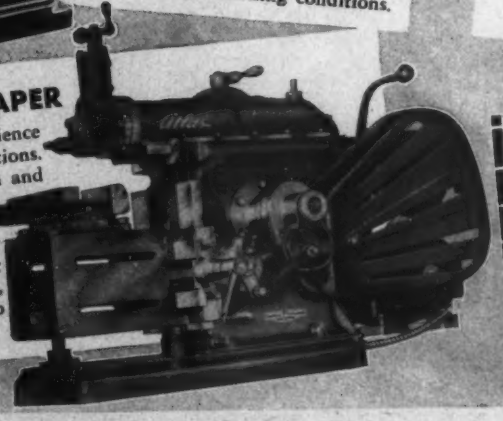
Training and production favorites. Long-lived, exclusive Atlas floating drive spindle for accuracy and utmost service. Bench and floor models available.

Atlas MILLING MACHINE



Ideal for quick training in every milling machine operation . . . from slabbing and facing cuts to end milling, keyway cutting, finishing and layout work. Precision, compact bench-type. Timken bearing equipped. Ruggedly built for long service under tough working conditions.

Atlas 7" SHAPER



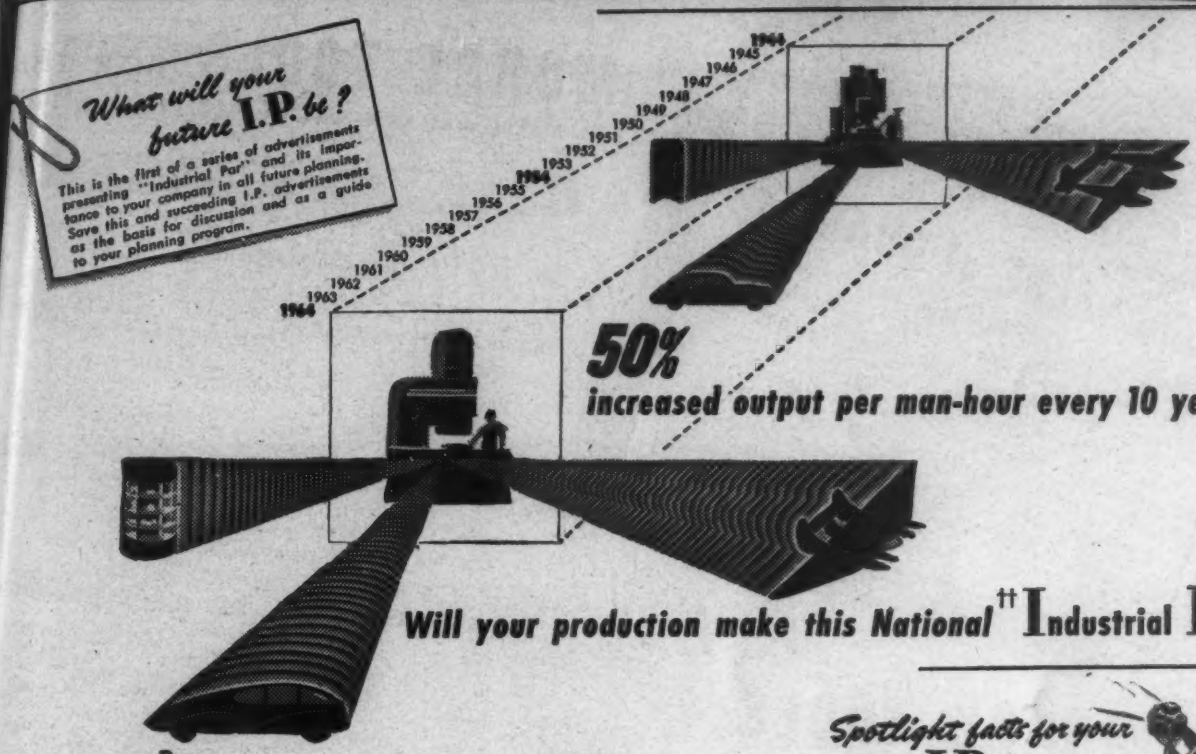
Gives excellent experience in all shaper operations. Has all the precision and power of larger machines built down to scale. Four speeds, five automatic cross feeds. Sturdy, dependable, built to take tough usage.

WALL CHARTS

Large, easy-to-read charts with up-to-date technical information on a variety of shop subjects are available at low cost.

Largest chart, on the Lathe, is 31½" x 25½". Others 16" x 21". These charts are ideal both for lecture work and also for using on wall for quick reference. Complete set of five charts sent postpaid for 25 cents.

LUFKIN TAPES • RULES • PRECISION TOOLS
The way a young man first learns to do things is usually the way he always does them. So it's mighty important that students use the kind of tools that go hand in hand with superior workmanship. More than fifty years experience and a record of constant leadership mean you'll always be right when you use Lufkin Tools.
THE LUFKIN RULE COMPANY
SAGINAW, MICHIGAN
New York City



50% increased output per man-hour every 10 years*

Will your production make this National †† Industrial Par?

RESEARCH reveals that in the 12 years, 1929-1941, the nation's output per man-hour increased 34%. The rate is 2½% per year compounded. And there is ample evidence accumulating that the rate will advance to at least 4%. War — the supreme national productive effort it calls for — accelerates man-hour output. Improved production techniques — developed in war — carry over into peacetime; the pent-up buying power released after Victory will tremendously stimulate production.

Thus manufacturers who intend to keep step with a high level of national prosperity — the volume production which means more goods for more people at lowest cost, and security of jobs and wages for the greatest number of workers — must strive to increase their output per man-hour 50% every 10 years.

To put it another way, American industry sets a definite national industrial PAR for man-hour output or production — 4% compounded per year rate of increase. The management of your company can determine its own competitive standing in terms of its ability to make or break this PAR.

Every industrial executive knows the key importance of machine tools in reaching production goals. Machine tools were basic to the phenomenal achievement of the American aircraft industry in attaining and surpassing the 60,000 plane quota set at the beginning of the war. The majority of the war industries — all machine tool users — were able to produce at a rate far in advance of the timetables set for them.

Manufacturing for peacetime markets is as much of a challenge as manufacturing for war. To make better products — faster — at lower cost — will call for the newest and finest machine tools — essential implements of production efficiency and the increased output that means security of jobs and wages.

Back the attack **BUY MORE BONDS**

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- *Manufacturers must set a goal of 50% increased output per man-hour every 10 years — to maintain a high level of national prosperity and achieve its benefits in terms of security of jobs and wages for the greatest number of workers and the volume production of more goods for more people at lowest cost.
- *Machine tools — the most modern, most efficient — are recognized as the most effective implements of mass production and increased output at lowest cost — but only continual replacements with the newest and finest machine tools assures full productive capacity. *Such replacements yearly should be equal to 10% of the total machine tool investment — in keeping with increased output.*
- *The cost of machine tools is insignificant in terms of their productive power . . . from 1927 to 1937, according to census reports, American manufacturers had only a total of about 2% invested yearly in machine tools in ratio to a total volume of 9 billion dollars' worth of production annually.

†† **Industrial Par** — *the constantly increasing output per man-hour equal to approximately 50% every 10 years.*

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THE advertisement above is reproduced from our current advertising campaign appearing in the business and industrial press. We believe these advertisements should be of interest and value to the young men who are being trained for tomorrow's industry, in terms of the trend and importance of machine tools to the industrial world of the future. May we suggest that you clip this advertisement and post it in your classroom or bulletin board so that it is brought to the attention of your students.

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The VALUE of QUALITY

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MORSE TOOLS
FOR THE SCHOOL SHOP

(*above*)
No. 302 Taper Shank Drill. Of selected carbon steel, for all power drilling not requiring high speed.

No. 330 Straight Shank Drill. So-called "Jobbers'" drill of carbon steel, for use in all types of hand and power drilling.

(*above*)
No. 602 Hand Reamer, Spiral Fluted, carbon steel reamer, ideal for general hand and machine use in the shop.

No. 717 Expansion Reamer. Available in ¼" to 2" diameters. Its expansion feature makes it highly useful in school shop work.

No. 1045 Spiral Pointed Hand Tap. For machine tapping of most common materials in through holes. Furnished in plug style only.

The Morse Catalog is a valuable 256-page reference book on quality cutting tools. A free copy will be sent to Instructors and Superintendents requesting it on their official School or Shop Letterhead.

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No. 1805 Heavy Duty End Mill. Coarse-toothed, spiral heavy-duty mill. Available in right-hand or left-hand types.
No. 1809 Alternate Tooth Milling Cutter. Alternate teeth provide a shearing cut and ample chip clearance for deep slotting in tough metals.

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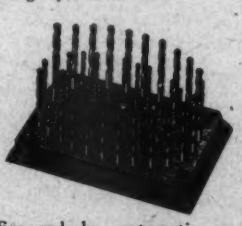

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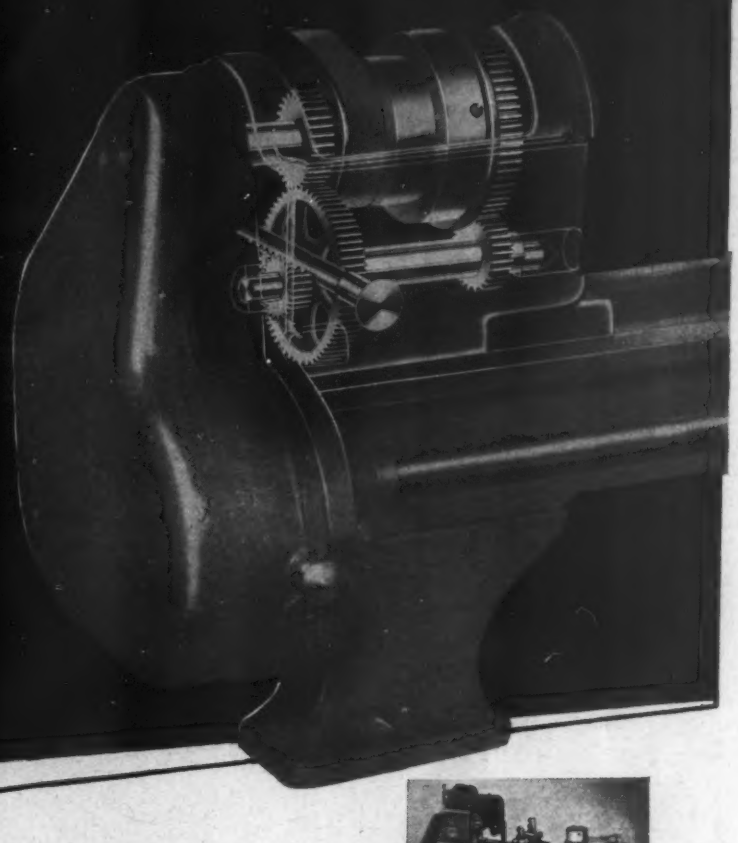

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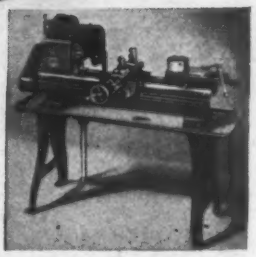

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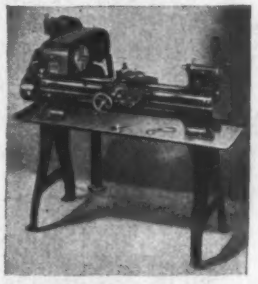

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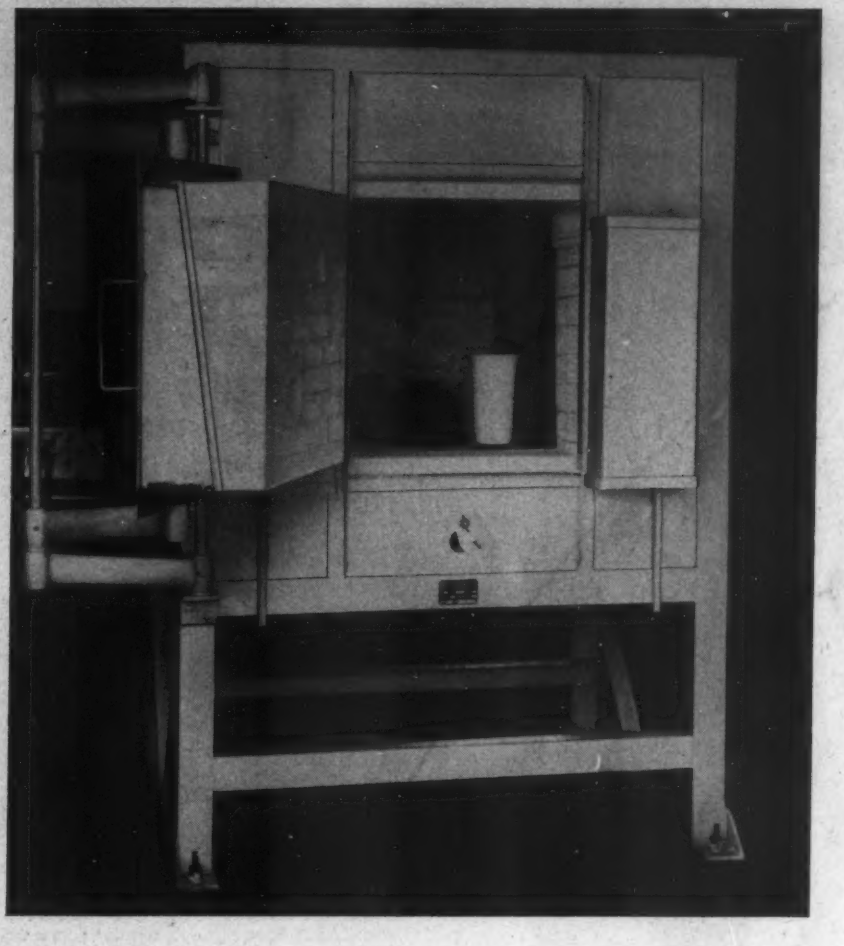

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EVER LOOK A FILE "IN THE TEETH"?

Time was when a file was simply "a many-toothed implement for abrading the surface or edges of metals and other materials." From it grew a limited range of shapes and sizes, with selection of cuts confined principally to "single," "double" and "rasp" cuts of varying degrees of coarseness.

For a large percentage of jobs, the mechanic used whatever *approximate* file happened to be at hand. Since then, industrial progress has ranged far and moved swiftly. As "time and work studies" began to raise shop efficiencies, file engineering advanced with equal speed.

Today, with Nicholson setting the pace, files and filing techniques are highly specialized. Research and experiment have produced literally *thousands* of kinds, cuts and sizes —each designed for some particular type of material and operation . . . for doing work better and quicker.

Oddly enough, it is in their minuter details—the *teeth*—that file distinctions have their greatest bearing on the work to be done and the results to be achieved. Look at the teeth of different files through a microscope or magnifying glass. Height, thickness, spacing, angle, type of edge, relative depth of overcut and upcut—all make for incalculable combinations and characteristics. For instance, certain Nicholson files have patented *serrated-tooth* construction, in which the teeth themselves have "little teeth" to provide successive cutting edges as others wear down. (See micrograph at left.)

Thus, selecting *The right file for the job* is vitally important. Files for stainless steel, aluminum, magnesium, brass, lead and babbitt, die castings, foundry castings, lathe filing, saw filing—all have cuts designed to meet the peculiarities of different materials, the amount of material to be removed, and the kind of finish the job requires. Files are indeed a *study*. It begins in the classroom and continues when the graduate takes up his position in the machine shop or assembly line.

Nicholson's 80 years' experience in file designing and manufacture has accumulated a vast fund of information that is open to training-school managements.

***"FILE FILOSOPHY"*— FREE** in usable quantities to school managements and instructors—contains much elementary and considerable advanced information on kinds, use and care of files. Nicholson and Black Diamond special-purpose files are obtainable principally from mill-supply houses; regular-purpose types generally from hardware stores as well.

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INDUSTRIAL ARTS and VOCATIONAL EDUCATION

VOL. 33 — MARCH, 1944 — Number 3

The 1944 School Shop Annual

Last year, when the SCHOOL SHOP ANNUAL appeared, war-production and preinduction training held the center of the stage. At the present time, these two activities are by no means to be overlooked, but other phases of industrial arts and vocational education are again coming to the forefront, and require consideration.

Shop planning, maintenance, and organization are always problems that confront the shop instructor, and they need constant attention if he wants to carry on his work in the most efficient manner.

Course outlines, too, demand the shop instructor's most earnest and continuous study, because a course outline must possess great flexibility and needs to be kept in a state of flux so that it may be adapted to conditions as they change.

Under the heading, "Miscellaneous," there are a number of very thought-provoking articles. Every instructor, whether he is teaching in the field of industrial arts or in that of vocational education will be interested in such articles as "Some Functional Aspects of a Vocational-Industrial Program," "A Functional Vocational School Diploma," "Manipulative and Nonmanipulative Time Elements," and "Grading in Terms of Our Objectives."

All of these articles were chosen because they will be of direct help to the shop teacher, and to those who have to supervise the work done by those teachers.

A few problems and projects were added for the extra value that they might give to the annual as an aid to the man for whom it is intended, the teacher who is training the workers of the future.

This Month's Cover

The picture chosen for this issue of the SCHOOL SHOP ANNUAL shows how the center portion of a pursuit plane is assembled with the aid of a jig. After the center has been assembled, it is joined to other plane sections, after which the nose, engines, wings, and other equipment are installed.

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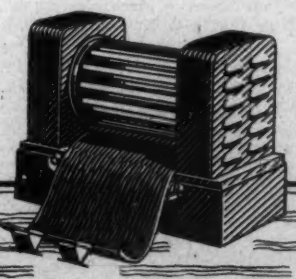

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The Montreal Technical School

IAN McLEISH*

Montreal, commercial metropolis of the Dominion of Canada, is the sixth largest city in America and the center of the greatest aggregation of water powers in the entire world.

The province of Quebec, in which this city is situated, has been wonderfully endowed by nature with myriads of lakes, which feed into numerous streams and rivers, which, in their more or less rapid descent from the Laurentian hills, offer wonderful possibilities for hydroelectric development, varying from a few thousand to several hundred thousand horsepower. In addition there is the mighty St. Lawrence, which at the Lachine, Cascades, Cedars and Coteau Rapids is capable of supplying more than three million horsepower to this most ideally situated metropolis. It has been estimated that a total of 5,000,000 horsepower lies within easy transmission distance of the city, while, for the whole province of Quebec, there is enough water power to supply 17,000,000 horsepower when fully developed.

Little wonder then that the late Sir Lomer Gouin, former premier of the Province of Quebec, looking ahead with clearness of perception, could visualize his province as the center of vast industrial enterprises. That his foresight has since been amply vindicated, one has only to visit Montreal, or to mention the one word — *aluminum* — to realize that gigantic developments have already taken place, with many others in course of realization.

Early in this century, Sir Lomer foresaw the necessity of making provision for the coming industrial era, by preparing the young men of his province to take an active part therein. He therefore decided upon the construction and endowment of the first technical schools in the province, one at Quebec city and the other, the larger one, in Montreal.

The Montreal Technical School first opened its doors to receive students in September, 1911, and, during the intervening 32 years, has trained thousands of the young people of the province, the majority of whom are now taking an active part in our industrial life, which today means the war effort.

The Montreal school is perhaps unique, in that it is the only bilingual technical school in the Dominion of Canada, instruction being given in both the English and French languages. This has involved a duplication of academic staffs, one set of teachers for the English section and another for the French. However, the same instructors teach both English and French students in the shops, where the training is more or less of an individual character.

The Montreal School differs from the technical schools in the other provinces of the Dominion, in that it is strictly a technical institution and not merely a technical high school. That is to say, it prepares young men directly for industry and *not* for university entrance. The technical high school admits to its classes boys and girls who have completed the elementary or primary school successfully, but the Montreal institution opens its doors to young men only, and these must have passed their second-year high school examinations or better, and, since the duration of the course is four years in both cases, the Montreal technician has a much higher standing at graduation than his counterpart in the other provinces.

The school offers two courses to intending students: the regular day classes and the evening classes. At the present time, in addition to the regular curriculum, many special classes are being held, such as the War Emergency Course for civilians and those for the armed forces. The regular day classes are given on a full-time basis with a definite program which each student is obliged to follow; whereas the evening classes are operated on a selective basis, that is, each student is free to make his own choice of the particular subject or subjects he wishes to study. In this article, the writer will confine himself to the four-year day course.

In his first year, the student does not specialize in any particular branch, but devotes himself to those subjects, such as mathematics, the sciences, English and French, which serve to prepare the ground for the following three years of specialization. In the shops, he spends about five weeks in each of the following departments: the machine shop, patternmaking shop, foundry, woodworking shop, smithy, and the electrical shop. This enables him to discover not only his own particular talents in any one or more of these trades, but it also gives him an insight into the operations carried on in these shops, as well as an acquaintance with the tools and the equipment used, which will stand him in good stead, should he advance later on to a position as shop foreman or superintendent.

At the beginning of the second year, each student is required to choose the precise trade in which he wishes to specialize, and, from that time on, all students, except those choosing electricity, spend whatever time they are in the shops in that particular shop in which their own special trade is being taught. Thus a student machinist devotes all his shop periods, in the second, third, and fourth years, to the machine shop; the student patternmaker to the patternmaking department, and so on. An exception is made in the case of those specializing in electricity; it is felt that the electrician needs more machine-shop practice than the other trades, though not as much as the machinists. For this reason, the electricals, as we call them, during the first half of their second year continue their training in the machine shop; from

*Vice Principal, Montreal Technical School, Montreal, Canada.

Fig. 1. Montreal Technical School. Front view taken from corner of Sherbrooke and Mance Streets

Fig. 2. General view of the Montreal Technical School

then on, they carry on in the electrical shops and laboratories.

During the whole of the specialization period, each student is required to continue his theoretical or academic training, so that, when he graduates, he not only has acquired manual dexterity in the shops, but, has in addition, a good working knowledge of English and French; algebra, geometry, trigonometry, and descriptive geometry; as well as of such subjects as thermodynamics, physics, chemistry, strength of materials, mechanical drawing, civics, applied mechanics, and accountancy. The following tables give a list of the subjects taught during the four years, with the number of hours per week allotted to each item in each year:

FIRST YEAR

	1st Semester	*2nd Semester*
Arithmetic	2	2
Algebra	3	3
Geometry	3	3
Physics	1	1
Materials	1	1
Mechanical Drawing	5	5
Freehand Drawing	2	2
English	3	3
French	2	2
Library and Civics	1	1
Shops	10	10
Total number of hours per week	33	33

SECOND YEAR

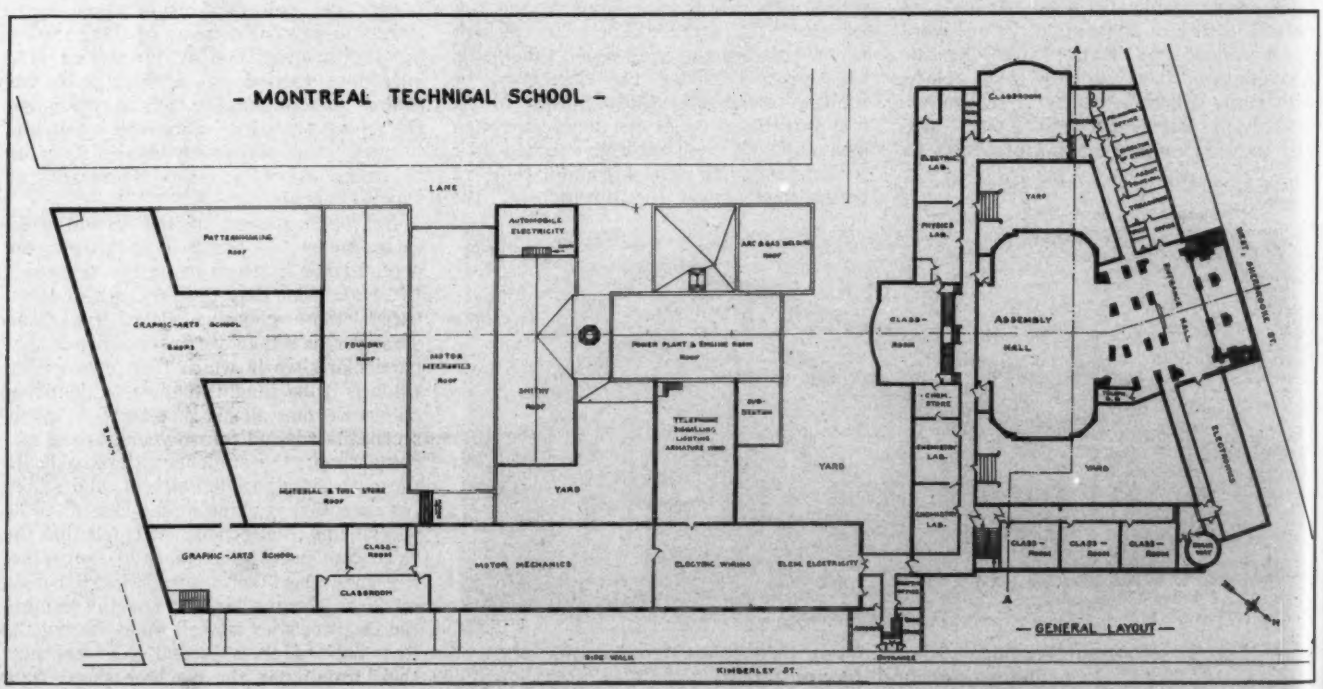
	1st Semester	*2nd Semester*
Algebra	2	2
Geometry	2	2
Trigonometry	1	1
Applied Mechanics	2	2
Physics (including laboratory)	3	3
Chemistry	2	2
Materials	1	1
Electricity	1	1
Mechanical Drawing	4	4
English	2	2
French	2	2
Gymnastics	1	1
Library and Civics	1	1
Shops	9	9
Total number of hours per week	33	33

THIRD YEAR

	1st Semester	*2nd Semester*
Algebra	1	0
Geometry	0	1
Physics and Laboratory	3	3
Chemistry	3	3
Electricity	4	4
Applied Mechanics	2	2
Mechanical Drawing	4	4
Descriptive Geometry	2	2
English	2	2
French	2	2
Shops	12	12
Total number of hours per week	35	35

FOURTH YEAR

	1st Semester	*2nd Semester*
Thermodynamics	1	1
Strength of Materials	1	2
Mechanical Drawing	4	4
Descriptive Geometry	2	2
Industrial Accounting	2	2
History and Geography	1	1
Civics	1	1
Industrial Safety and First Aid	2	
Heating and Ventilation	1	
Industrial Visits	1	1
Industrial Legislation	1	
Radio (Electricals)		1
Air Conditioning		1
French	2	2
Shops (Electricals: Electrical Testing, 3 hrs.; Shops, 12 hrs.)	15	15
Total number of hours per week	34	33



It would take too much space, in a brief article of this nature, to give a detailed account of the theoretical subjects forming the academic portion of the curriculum, so the writer will confine his attention in what follows to a brief survey of the shops and their activities.

In the first year, students of each section (English and French) are divided into six groups for distribution among the following shops: machine shop, carpenter shop, patternmaking shop, electrical shop, smithy, and foundry. Each group spends five weeks in each of these six departments during the course of the scholastic year. The five-week program in each shop is designed, not only to familiarize the student with the equipment, tools, and operations performed in each trade, but also to acquaint him with working conditions, the possibilities of the trade and chances for advancement. In other words, his passage through the various shops enables the student to orient himself toward that particular specialty for which he seems best fitted. Besides, each shop instructor keeps a record of the marks obtained by all the students in his department, and, the students' standing determines, to a large extent, the advice given them as to which specialty they should follow. *The first year, then, is a period of orientation.*

On entering the second year, the students are divided into groups according to the specialty chosen, and, they are then classified as mechanicals, electricals, building construction, etc. No matter, however, what their particular trade or profession may be, the academic studies are the same for all. It is only in the drafting and the shops that any differentiation is made between the specialties. In drafting, the mechanical technicians follow a course in straight mechanical drawing, while the electricals take the same drafting as the mechanicals, during the second and third years, but, in the fourth year, they switch to electrical drafting and design. Students in building construction and all branches of woodworking, on the other hand, specialize in the drawing of their own trade, from the start of the second year right through to the end of the fourth year.

In the shops, the mechanicals and electricals, at the beginning of the second year, start at the south end of the machine shop, next to the Graphic-Arts School (see ground floor plan), where they are initiated in the mysteries of benchwork, chipping, filing, and scraping, etc. After they have passed the various tests in benchwork and have become accustomed to the machinery about them, they make a start on the smaller lathes, which are located at this end of the machine shop. They now learn turning, tapering, screw thread cutting, etc. After completing a whole series of exercises during the course of the second year, they wind up by doing all the machine work necessary to make a complete machine-shop vise (small size). The drawings, patterns, rough castings, etc., employed in the manufacture of these vises and any other machines produced by the school, all come from our own drafting room, pattern shop, and foundry.

During the third and fourth years, students, specializing in machine shop, move to the other end of the machine shop, where the machines are larger and more varied in their application. Here they carry on more advanced machine-shop work, for example: cutting teeth for spur gears, bevel gears, spiral gears, worms, and worm-wheels, etc. At the present time, too, we are manufacturing, as an exercise, four complete 13 in. by 5-ft. engine lathes, which should be ready for installation in our own shops by next May or June. These lathes were designed in our own drafting room, from where the blueprints were forwarded to the pattern shop, where the patterns for all the parts were made (bed, legs, headstock, tailstock, apron, etc.). The completed patterns were then delivered to the foundry, where the molds were made, after which the cupola (see no. 1 on foundry plan) was started up and later the molten metal poured into the molds prepared by the foundry students. In past years, we have manufactured a number of lathes, both machine shop and wood turning, many of them complete with electric motor, also designed and made by the students as shop exercises. The winding of these motors was, of course, done by students specializing in electricity. Other machines completed in the machine shop include one 14-in. cone shaper, one No. 2 plain milling machine, about fifty small electrically driven band saws, jig saws, and buzz planers. Many of these machines are still in use in our own shops, others have been sent to sister technical schools, which do not possess a complete foundry, smithy, and the like, capable of turning out equipment of this nature.

Besides learning how to do all the operations on lathes, planers, shapers, milling machines, grinders, etc., each machine-shop specialist learns something about the heat-treatment of metals in the heat-treatment room just off the center of the main machine shop (see ground floor plan). Here he learns the mysteries of tempering, annealing, case-hardening, etc.

Electrical specialists, on the other hand, as soon as they have completed what is considered sufficient machine-shop practice, which occurs at the middle of the second-year program, proceed to the electrical shops, where they start a program intended to convert them into what might be termed electrotechnicians. Among other things, they learn how to wire buildings, employing the usual standard methods; they must master the Canadian electrical code; they also study the construction, operation, and repair of electrical equipment of all kinds, which introduces them to armature winding, transformer winding, relays, starters, etc. In the electrical testing department, the student learns how to test both a.c. and d.c. generators and motors, which includes plotting the usual curves, such as saturation and load characteristic curves. All this training is in addition to the theoretical lessons and laboratory work in electricity, which is carried on in the main building, distinct from the shops. In the shops, the students receive their instruction from practical tradesmen, in the main building their training is carried on by academic instructors.

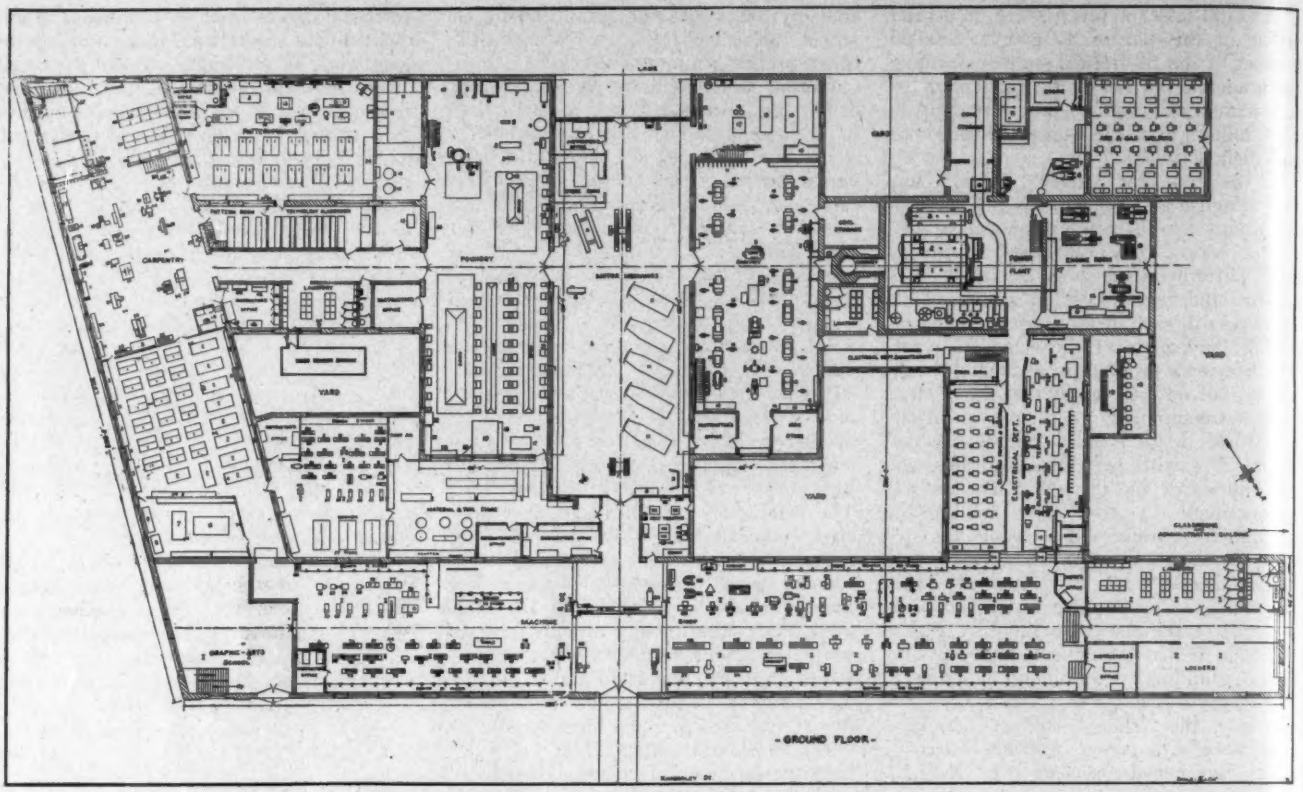
At the south end of the building is located the carpenter shop, where pupils specializing in building construction devote their shop periods, during the past three years, to learning the intricacies of their trade. Specialists in this branch learn how to construct doors, windows, and other building details, including stair building, roof construction, and sometimes a complete building, which also gives the electrical experience in house wiring. Alterations to the school, furniture, drawing boards, etc., also provide plenty of practical experience for the specialists in the woodworking department.

Adjacent to the carpenter shop, on the west side of the buildings (see ground floor plan), is the patternmaking shop, where students who desire to specialize in this branch spend their shop periods. At one side of the shop is a technology classroom for patternmakers, where the principles of their trade, materials used, etc., are set forth, later to be applied in the shop itself.

The foundry, naturally, is located right next to the patternmaking shop, for these two departments work closely, hand in hand. One half of the foundry floor space is taken up by the workbenches, while the remainder lodges the cupola, tumbling mill, sand blast, and other foundry equipment. In side rooms off the foundry are located respectively the blower for the cupola and two oil furnaces for nonferrous metals and alloys. A third oil furnace is now in course of construction in the school and will be installed very shortly. Young men specializing in this shop, not only learn the art of molding, both by hand and by machine but also acquire a knowledge of foundry practice in general, including the running of the cupola, the metallurgy of metals, the latter being supplemented by chemistry in the academic course.

In the center of the shops, just behind the Kimberley Street entrance to the machine shop, lies one portion of the motor-mechanics department (see ground floor plan). Here regular garage work is done on cars brought in for that purpose; off the end of this shop, behind the smithy, is located the battery repair and charging room, where the student learns how to construct batteries as well as how to repair them. Above the battery room, is a combined class and demonstration room (see first floor plan), where the electricity of the motorcar is mastered by student motor mechanics.

On the upper floor, above the machine shop (see first floor plan), is located the balance of the motor-mechanics department, comprising two lecture rooms, one for English students, the other for French,



Ground floor, Montreal Technical High School

GROUND FLOOR
AUTOMOBILE DEPARTMENT

(1) Bench; (2) grinder; (3) brake lining machines; (4) hydraulic auto lifter; (5) brake testing machine; (6) hydraulic press; (7) wheel aligning device; (8) auto part weighing tank; (9) painting outfit; (10) fan; (11) auto chassis; (12) emery grinder; (13) lathe 14 in. by 5 ft.; (14) drill press; (15) air compressor; (16) gas welding outfit; (17) welding table; (18) battery construction and repair; (19) battery charging.

BLACKSMITH SHOP

(1) Electric hammer; (2) belt driven hammer; (3) shear and punch; (4) 20-in. drill press; (5) polisher; (6) ford smith nibbling; (7) gas welding; (8) electric welding unit; (9) table for tools; (10) cupboard for tools; (11) rack for stock bars; (12) double wheel grinder; (13) forge fires; (14) anvils; (15) workbench; (16) ladder to ventilating fan.

ELECTRICAL DEPARTMENT

Electric Motors and Control: (1 to 12) D.c. motors, manual and automatic d.c. starters and controllers of different types and makes; (13 to 30) A.c. motors, manual and automatic a.c. starters and controllers of different types and makes. Each motor with its control devices are mounted on a separate table; (31) cabinet; (32) workbench; (33 and 34) tables and panels on which are mounted small motors and various control devices such as: time switch, limit switch, float switch, pressure switch, contactors, relays, small a.c. starters and controllers.

Electrical Testing: (1) Main motor-generator set:. 1–25 K.V.A., 120v 3ph. 60 cycle alternator and exciter direct connected to a d.c. 40 h.p. 1200 r.p.m. 115v d.c. motor; (2) control panels for preceding motor-generator set; (3) 3-phase loading switchboard; (4) lamp bank; (5) main switchboard composed of 20 control panels; (6) 3–5 K.V.A. transformers 550/110v; (7) bench and a panel on which are mounted: transformer, watt hour meters, and rheostats; (8) welding transformer; (9) cabinet with 60 portable measuring instruments; (10) temporary test switchboard; (11) motor-generator set: 5 h.p. 115v shunt motor direct connected to 115v shunt generator; (12) motor-generator set: 10 h.p. 115v d.c. motor direct connected to 5 K.V.A. 120v alternator; (14) synchronous converter d.c. 125v, 40A, a.c. 125v 1800 r.p.m. 60 cycle-type ACPC; (15) motor-generator set: 10 h.p. 115v d.c. motor direct connected to 5 K.W. 115v compound generator; (16) motor-generator set: 10 h.p. 115v d.c. motor direct connected to 5 K.V.A. 120v alternator; 12A to 16A are: control panels, starting and field rheostats for the different units; (17) 7.5 h.p. 550v 3-phase induction motor equipped with a Prony brake; (18) compensator 7.5 h.p. 550v 3ph.; (19) automatic telephone exchange; (20) power panel for the automatic telephone system; (21) d.c. motor-generator set; (22) water barrel rheostat; (23) rectifier; (24) 5 h.p. 110v 3-phase induction motor; (25) 10 h.p. 110v d.c. motor; (26) X-ray transformer; (27) flywheel.

FOUNDRY

(1) Cupola; (2) tumbling mills*; (3) emery wheel; (4) sand mill; (5) buffer; (6) dust collector; (7) sand blast; (8) elevator; (9) sand bins; (10) pig iron bins; (11) foundry material bins; (12) oil furnaces; (13) blower for cupola; (14) band saw for metals; (15) water tub and hose; (16) demonstration bench; (17) table used for technology lectures; (18) pattern shelves; (19) large core oven; (20) small core oven; (21) coremaking bench; (22) shelf for coremaking material; (23) shelf for cores; (24) molding bench; (25) molding bench; (26) portable ladle, crane overhead trolley.

PATTERNMAKING

(1) 24 workbenches; (2) 2 workbenches (long); (3) tracing table; (4) cabinet for 24 tool sets; (5) special tool cabinet; (6) instructor's tool chest; (7) cast-iron surface plate 24 in. by 32 in.; (8) turning lathes*; (10) DeWalt 12-in. saw — 1½ h.p.; (11) buzz planer — 12 in.; (12) circular saw — 12 in.; (13) drum sander; (14) disk sander; (15) band saw 32 in.; (16) planer 18 in.; (17) gluing presses*; (18) 6-in. buzz planer, 14-in. band saw*, and portable drill; (19) 6-in. tool grinder; (20) glue pot; (21) sink, cold and hot water; (22) molding bench (demonstration); (23) flexible shaft grinder; (24) wood rack.

MACHINE SHOP

(1) 2 arbor presses 12 in.; (2) lathe 16 in. by 6 ft.; (3) lathe 11 in. by 3½ ft.; (4) lathe 14 in. by 6 ft.; (5) lathe 13 in. by 5 ft.; (6) center drilling machine; (7) sensitive drill; (8) sensitive drill*; (9) lathe 12 in. by 5 ft.; (10) lathe 15 in. by 6 ft. with spg. collets; (11) shaper 16 in.; (12) shaper 14 in.; (13) lathes 13 in. by 4 ft.; (14) Do-All metal master, model ML; (15) dry grinder* 10 by 1 in.; (16) vertical milling machine; (17) universal milling machine; (18) drill press; (19) vertical milling machine; (20) universal milling machine; (21) lathe 16 in. by 10 ft.; (22) lathe 12 in. by 6 ft.; (23) lathe 20 in. by 8 ft.; (24) lathe 16 in. by 8 ft.; (25) lathe 24 in. by 8 ft.; (26) vertical boring mill 28 in.; (27) lathe 16 in. by 8 ft. fitted with metallizing gun; (28) lathe 16 by 12 in.; (29) radial drill, 3 ft.; (30) lathe 13 in. by 6 ft.; (31) lathe 13 in. by 5 ft.; (32) lathe 15 in. by 6 ft.; (33) lathe 15 in. by 6 ft.; (34) lathe 12 in. by 5 ft.; (35) shaper 16 in.; (36) shaper* 16 in.; (37) shaper 14 in.; (38) speed lathe 10 in. by 4 ft.; (39) drill press 20 in.; (40) drill press 16 in.; (41) drill press 20 in.; (42) speed lathe 6 by 30 in.; (43) lathe 12 in. by 5 ft.; (44) wet grinder 20 by 2½ in.; (45) plain milling machine; (46) arbor press* 6 in.; (47) lathe 16 in. by 6 ft.; (48) universal milling machine; (49) automatic gear-cutting machine; (50) universal milling machine; (51) tool cabinet for jig borer; (52) jig borer 10 by 16 in.; (53) jig borer, 6 by 12 in.; (54) punch press; (55) punch press; (56) key seater; (57) slotting machine 12 in.; (58) universal grinder; (59) tool grinder; (60) surface grinder; (61) straightening press*; (62) universal blackboard*; (63) surface grinder 12 in.; (64) shaper 20 in.; (65) automatic saw; (66) hardness testing machine (Brinell); (67) horizontal boring mill; (68) planer 36 by 96 in.; (69) planer 18 by 48 in.; (70) tool grinder; (71) lathe 14 in. by 6 ft.; (72) lathe 14 in. by 6 ft.; (73) lathe 13 by 5 in.; (74) lathe 14 in. by 6 ft.; (75) automatic screw machine No. 20; (76) hand screw machine; (77) hand screw machine 0 to 1 in.; (78) milling machine*; (79) shaper 12 in.; (80) shaper; (81) shaper; (82) shaper 12 in.; (83) drill press; (84) drill press 20 in.; (85) drill press; (86) sand stone wet wheel; (87) shaper 9 in.; (88) arbor press; (89) drill press 15 in.; (90) lathe 10 in. by 4 ft.; (91) lathe 12 in. by 5 ft.; (92) portable crane*; (93) portable crane; (94) T.S. electric furnace 27 by 36 in.; (95) H.S. electric furnace 27 by 30 in.; (96) automatic control panel; (97) gas muffle; (98) cyanide bath; (99) gas furnace; (100) oil quenching tank 26 by 38 in.; (101) water quenching tank 26 by 38 in.; (102) anvil; (103) oil drawing tank 26 by 36 in.

*Manufactured at the Montreal Technical School.

WOODWORKING DEPARTMENT

(1) Workbench 3 ft. 6 in. by 2 ft.; (2) workbench 8 by 4 ft.; (3) tool cupboard; (4) special tool cupboard; (5) drawing table; (6) drawing table for demonstrations; (7) instructor's drawing table; (8) bookcase; (9) cupboard for construction plans; (10) chief instructor's office; (11) cupboard for woodturning lathe tools; (12) filing bench; (13) cupboard for machine tools; (14) filing machine; (15) sand-stone wet wheel; (16) planer's iron grinder; (17) horizontal sander; (18) dowel-making machine; (19) emery wheel; (20) horizontal drill press; (21) shaper; (22) sensitive drill press; (23) band saw;

*Manufactured at the Montreal Technical School.

(34) circular saw; (25) planer; (26) side planer; (27) router; (28) chain mortiser; (29) hollow chisel mortiser; (30) table for small band saw and small side planer; (31) jig saw; (32) woodturning lathe; (33) woodturning lathe; (34) woodturning lathe; (35) tenon machine; (36) veneer press 4 by 8 ft.; (37) wood drying kiln; (38) paint cupboard; (39) stairway to varnishing room; (40) lumber store; (41) instructor's lockers; (42) desk; (43) special tools cupboard; (44) desk; (45) first aid cabinet; (46) angle cutter; (47) molding machine.

GAS AND ELECTRIC WELDING

(1) Gas welding outfit; (2) transformer, Wilson; (3) transformer, Cirkal; (4) generator, Lincoln; (5) generator, General Electric, Type WD-32; (6) generator, General Electric, Type WD-200A; (7) generator, Hobart; (8) generator, Pawling and Harnischfeger; (9) generator, Westinghouse; (10) generator, General Electric, Type WD-3200; (11) generator*.

POWER PLANT AND ENGINE ROOM

(1) Babcock and Wilcox boiler, with chain grate stoker; (2) Babcock and Wilcox boiler, with Enco oil burner; (3) Babcock and Wilcox boiler, with Volcano stoker; (4)*forced circulation turbines; (5) boiler pump; (6) scales; (7) air compressor; (8) air compressor; (9) oil pump; (10) oil tank; (11) oil tank; (12) Bellis-Morcom vertical steam engine and dynamo; (13) Robb-Armstrong horizontal steam engine and dynamo; (14) Corliss horizontal steam engine and dynamo; (15) Diesel motor and dynamo; (16) Van Blurk marine engine; (17) distribution panels for direct current; (18) transformer room; (19) distribution panel for alternating current; (20) meter board.

FIRST FLOOR
ELECTRICAL DEPARTMENT

Electric Wiring: (1) tables with panels on which are mounted a number of switches, receptacles, etc., for various circuits; (2) panels for the practice of different wiring methods; (3) single-phase 110/220v 400A service entrance; (4) 3-phase 550v 60A service entrance; (5) workbenches; (6) various tools for conduit work; (7) test boards; (8) wiring material cabinet; (9) tool cabinet; (10) stockroom.

Telephone, signaling, lighting, etc.: (1) apartment house telephone and intercommunication system; (2) fire and burglar alarm systems, electric clock, relays, thermostats, heating elements; (3) annunciators, relays; (4) relays, annunciators, heater switches; (5) apartment house telephone system, fluorescent lamps; (6) wheatstone bridges and cable testing; (7) electronics; (8) switchboard; (9) manual telephone exchange; (10) automatic telephone exchange; (11) material cabinet; (12–13) workbenches; (14) battery room.

Armature winding department: (1–4) tables and equipment for d.c. and a.c. winding; (5) workbench for motor repair; (6) slot forming machine; (7) coil forming machine; (8) shear; (9–10) large armature supports; (11) baking oven; (12) lathe; (13) transformer installation; (14) bench with different types of a.c. motors; (15) layout, sketching.

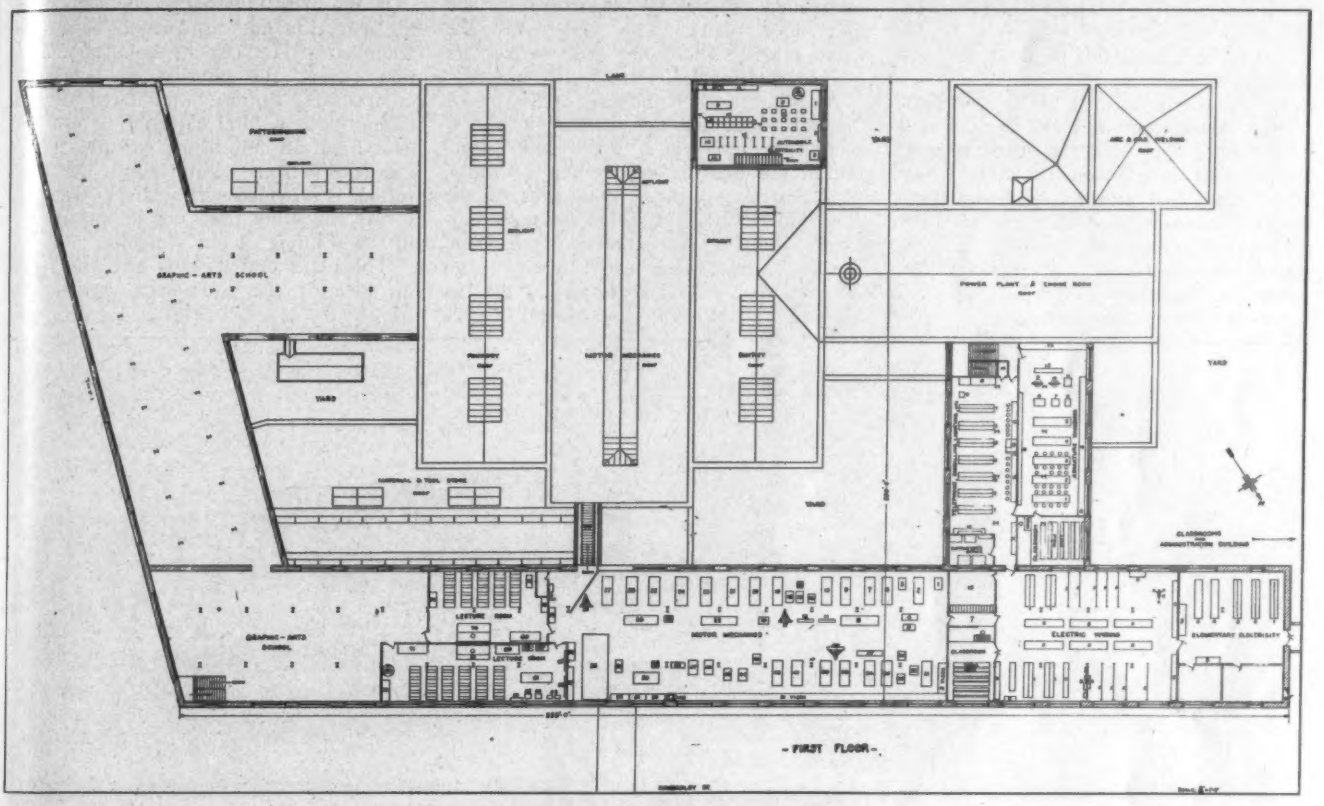
Elementary electricity: (1) lighting circuits; (2) signal circuits; (3) testing panels; (4) workbenches; (5) cupboards.

MOTOR MECHANICS

(1) Cadillac motor; (2) Graham-Paige chassis; (3) Willis-Knight motor; (4) Hispano-suiza motor; (5) Cirrus motor; (6) Chrysler chassis; (7) Chrysler chassis; (8) Packard chassis; (9) Chrysler chassis; (10) Buick chassis; (11) front-axle four-wheel drive; (12) Ford truck differential; (13) lighting plant, Caros; (14) Lacherrotiere marine engine; (15) Evenrude outboard engine; (16) Ford motor; (17) Chevrolet differential four-wheel drive; (18) Studebaker chassis; (19) Ford engine, display; (20) Chrysler chassis; (21) Chrysler chassis; (22) LaSalle chassis; (23) Chevrolet chassis; (24) Dodge chassis; (25) Dodge chassis; (26) Plymouth chassis; (27) Ford chassis; (28) Graham-Paige chassis; (29) Ford transmission, Model A, display; (30) Ford differential, display; (31) Durant chassis; (32) Stutz motor; (33) Continental motor, display; (34) Wright-Whirlwind motor; (35) Plymouth chassis; (36) Whippet chassis; (37) Chevrolet differential 1942 four-wheel drive; (38) Auburn chassis; (39) Chandler chassis; (40) Ford differential 2-ton truck; (41) Chrysler chassis; (42) Dodge chassis; (43) Lycoming motor; (44) Ford motor, Model A; (45) 4-cylinder motor, T type, display; (46) Chalmers motor, display; (47) sleeve valve motor, display; (48) 12-ton mechanical press*; (49) bench drill press; (50) tool cabinet; (51) display cabinet; (52) standard bolts, nuts, etc.; (53) demonstrating table 4 by 8 ft.; (54) Ford motor, display; (55) Ford transmission display, model 85; (56) turn auto stand for demonstration — Graham-Paige chassis attached; (57) auto-parts rack; (58) table; (59) test bench; (60) Whippet chassis, display; (61) Chrysler chassis, display; (62) auto-parts panel; (63) steering gear, display; (64) knee-action, display; (65) recirculating ball steering gear; (66) petroleum products cabinet; (67) Chevrolet motor, display; (68) Buick front axle, display; (69) mechanical parts demonstrating table; (70) desk and blackboard; (71) electrical accessories table; (72) universal blackboard; (73) manifold display; (74) 9-cylinder Wright motor, display; (75) lighting display panel; (76) auto-part table; (77) combined stair and auto ramp.

Automobile Electricity: (1) demonstrating table; (2) battery-section panel; (3) generator and starter testing bench; (4) universal blackboard; (5) desk; (6) cupboard; (7) soldering irons; (8) generators, starters, coils, magnetos, etc.; (9) demonstrating table; (10) workbench; (11) Mica undercutting machine; (12) electric wiring systems, 7 panels; (13) electric troubles, Buick motor; (14) electric furnace 12 by 24 in.; (15) folding chairs; (16) growlers.

*Manufactured at the Montreal Technical School.



First floor, Montreal Technical High School

*Manufactured at the Montreal Technical School.

the rest of the floor space being given over to beginners, who learn how to demount and assemble and finally test all types of motors. For the duration of the war, this department, in the daytime, has been turned over entirely to the training of men from the army, who come in groups of 72.

Next to the motor-mechanics department on the ground floor lies the smithy, with its 24 anvils and fires for the training of specialists in the art of ornamental ironwork. Many fine pieces of wrought iron construction, such as wall brackets, curtain rods, wrought iron stair balusters, etc., have been executed by students in this shop.

At the rear of the electrical shop and next to the smithy is the school power plant,

where one finds the boilers and engine-driven generators, with accessories of all kinds, including CO_2 recorders, steam-flow meters (both mechanical and electrical), etc., so that quite a comprehensive course is given, both theory and practice, in stationary engineering.

Behind the engine room is located the welding department, where instruction is given in both gas and electrical welding. For a time, during the rush to build ships, this shop was running 24 hours a day, in three shifts, turning out men for the shipbuilding industry.

In the corner formed by the electrical testing department and the engine room (see ground floor plan) is located a small substation, where power from the Montreal Light Heat and Power Company is stepped down from 4400 volts for local distribution throughout the shops. This addition was made necessary when our own generating capacity proved insufficient to meet our ever growing requirements.

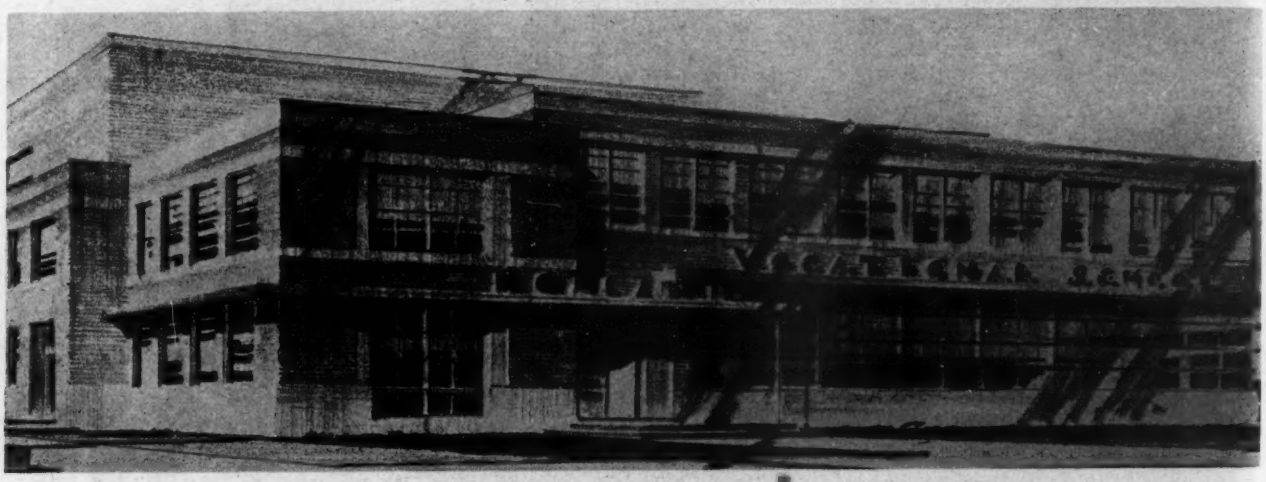
Finally, above the ground floor of the electrical department and also above the north end of the machine shop is situated the balance of the electrical shops (see first floor plan) — one section devoted to telephones, fire and burglary alarms, annunciators, relays, electric time clocks, etc. — another section to armature winding; while above the north end of the machine shop, the space is taken up by the wiring and elementary electricity departments (see first floor plan). Two classrooms are located here, where the shop instructors give lessons in electrical shop technology.

An innovation on the part of the school has just been announced. This is a new section in *electronics*, which will incorporate the existing department of radio, plus a study of the various uses of the thermionic valve in industry and commerce, and, very likely, later on, television. Students specializing in electricity from now on may choose electronics at the beginning of their third year instead of general electricity as hitherto. The new electronics laboratory will be located in the main building of the school and not in the shops as is the case with the rest of the electrical division.

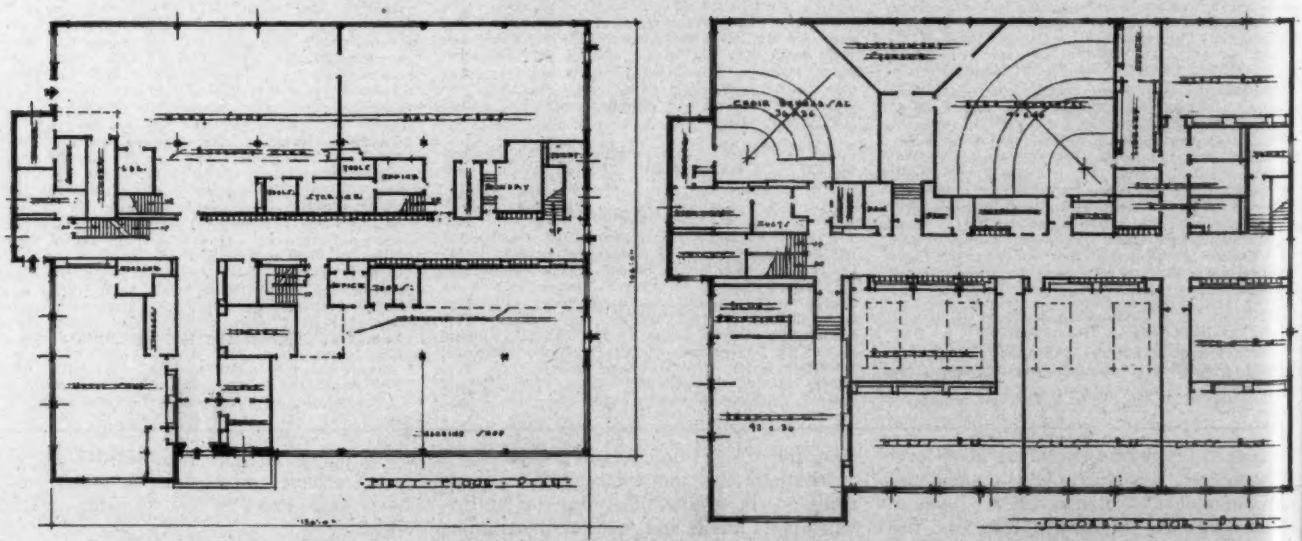
A new department in plastics has been under way for some time, but, owing to delay in obtaining the required equipment, due to war conditions, classes have not as yet started in this subject.

In the main building of the school (see the general layout) are located, besides the administrative offices, all the academic lecture rooms, the physics and chemistry laboratories, library, four large drafting rooms, with a total capacity of 160 students, and an auditorium capable of seating 600 persons comfortably. The auditorium is provided with a silver screen, for visual education plays an important part in the training of our students.

The plans and legends give the reader an idea of the equipment used at the Montreal Technical School.



Architect's Perspective, Holland Vocational School, Holland, Michigan. — Warren S. Holmes Co., Architects, Lansing, Michigan



Holland Shop and Music Building, Holland, Michigan. — Warren S. Holmes Co., Architects, Lansing, Michigan

The Frantz Industrial-Arts Building

S. M. DELL*

In 1917 a few young men at McPherson College were permitted to use some available tools and equipment in the basement of the men's dormitory which had formerly been used as a kitchen. The men returning to college after the Armistice of World War I were no longer satisfied with the traditional courses of the academic curriculum, for they had learned some of the values of technical information and skills. They insisted on a broader curriculum, for their experiences had taught them the value of education, but not all wanted to enter the professional fields as many graduates of a liberal arts college were wanting to do.

Since a wise college president saw great value in "manual training" as a character building agency, he both approved and assisted in its eary promotion and development. Throughout the years the department gained for itself a place in the curriculum and the respect of other departments. During the early years many men took the courses in drawing and woodwork and became teachers of this new work in the secondary schools. In more recent years both men and women availed themselves of the many activities provided in the industrial-arts department and have not only taught, but have entered many of the walks of life.

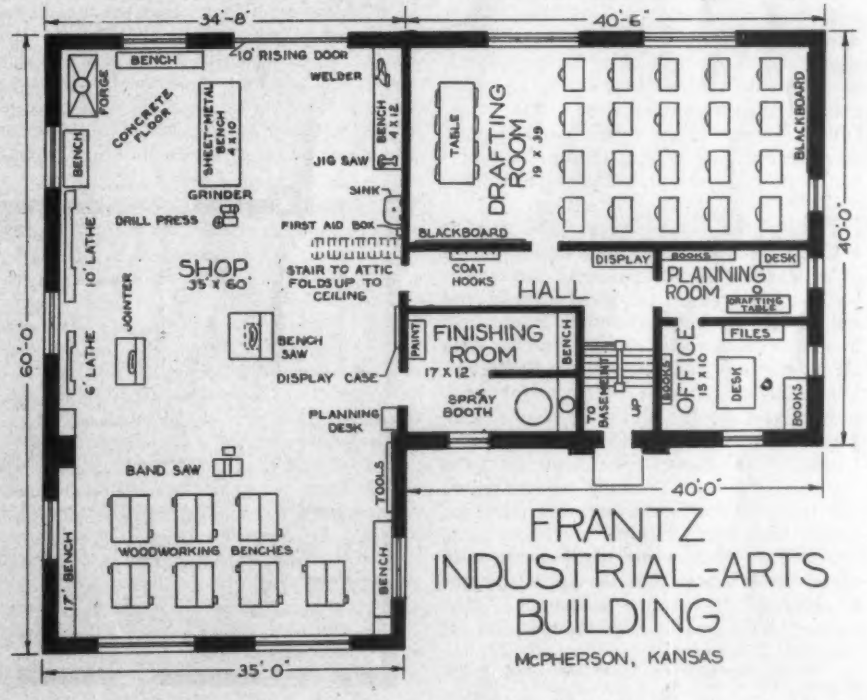
But as buildings do, this dormitory became old and no longer serviceable as a home for men. A splendid new home was erected for the men, but there was no provision for the industrial-arts department in that building.

For a while the future of industrial arts at McPherson College appeared rather dark, until a young businessman who served on the board of trustees, sensing the spirit of the group, said "I believe I can work out a plan so that industrial arts can have a building of its own and can continue the splendid work it is doing. Industrial arts can help itself, for it has long been known as 'a study of the changes man makes in the form of things so that they may conform more to his needs.' The old men's dormitory is still standing and has much good material which can be utilized in a new building."

Plans were discussed to salvage the 40- by 100-ft. building, which consisted of three stories and a basement. The foundation was Kansas limestone and, besides extending several feet into the ground, it reached to the first floor which was 6 ft. above the ground. The upper stories were frame construction, brick veneered. The dimension stock was all full size and was secured with square cut nails. (Nearly two tons of these old nails were sold for salvage.)

Plans were developed and approved, but were subject to change depending upon the condition of the salvaged materials as very little new material could be purchased. Not only was this true from an economic standpoint, but also from the point of its availability. The industrial-arts building is a one-story building with full basement and an attic. There are 3700 sq. ft. of area on each floor with storage for lumber and supplies in the attic. Sufficient stone was salvaged to face the masonry construction of the entire building. The bricks were used to form a double wall back of the stone. This makes the walls strong enough to support several more stories if the time comes when more room is necessary. All broken and chipped pieces of rock and brick were used in the basement walls to help conserve the concrete. Window frames were cut down and rebuilt. Windows were selected and fitted into the new frames.

Frantz industrial-arts building



*McPherson College, McPherson, Kans.

Old doors were squared up, used flooring boards were cleaned, relaid, sanded, and finished. Walnut stair rails were redesigned and utilized, for the beautiful patina of many years' aging cannot be produced in new wood.

The stone threshold of the main entrance in the old building was placed intact over one of the doors as a reminder of the many persons who had passed into its halls. The structure is called Frantz Industrial-Arts Building, for in the plan suggested by the member of the board of trustees, the Frantz's who attended school financed the building.

The Frantz Industrial-Arts Building stands as a memorial to industrial arts as something that is practical, beneficial, and worth while. The materials for the most part are not new, but to most observers they appear to be so. In their new usable form these materials, no longer serviceable as they were, can now provide opportunity for men and women who want a truly liberal education, to experiment, to learn through tangible means many significant skills necessary for their needs and, last but not least, to obtain a better understanding and appreciation of the industrial society in which we live.

Industrial Arts in a Small High School

ENSIGN WM. F. JOHNSON, U.S.C.G.R.*

A small school is always faced with the problem of finding room for its industrial-arts shop. Many schools have ideal setups, but more, especially those in rural areas, are barely able to find a place in some out of the way corner of the basement for their shop.

Industrial arts has been a part of the curriculum of the Union Free High School, Frederic, Wis., for approximately nine years. At first, anyone who could teach a class or two of woodworking was promptly given the job. Since 1936, however, there have been but two instructors. The entry of the United States into World War II brought to a close the tenure of the writer and also temporarily discontinued the department because a new teacher could not be obtained.

The type of industrial-arts shop that has been in operation in Frederic has been the general shop. Activities that have been carried on for some time are woodworking, metalworking (bench, sheet, and forge work), electricity, and drafting. Three classes for boys and one for girls have been provided. General education and avocational aims were those that were of paramount interest. Home repair was a specific aim for the girls. Equipment in the shop has consisted of hand and small power tools.

During the school year 1940–41 the Union Free High School had an enrollment of approximately 300 students, the majority of whom came from rural homes. It is easy to see then, that the main interests in having a department of this kind lie with those coming from homes of this kind. While this is an article dealing mainly with industrial arts, the status of the agricultural department must also be considered. Classes in vocational agriculture are given for the purpose of teaching modern farming methods, farm management, and the repair and care of farm machinery. The latter is well taken care of by a course in farm mechanics which is taught by the vocational agriculture instructor. Milk testing has been provided for and at present the students are using a testing room in the new shop building. The old milk testing room was hard to keep clean and was not in an ideal location in the main school building. Of the 300 students mentioned above, 100 were enrolled in the four industrial-arts classes. Thus, one third of the students in school were taking industrial arts, as an elective, and at least another 15 were enrolled in the farm mechanics class. The shop room that was used was perhaps typical of those found in northern Wisconsin today. It contained approximately 900 sq. ft. of usable space for actual shopwork. About the only storage space available for projects was in the form of shelves. Large projects had to be left out on the floor area.

Besides this the shop had to be used as a dressing room for the athletic teams, and water left on the floor after showers made it impossible to control the humidity.

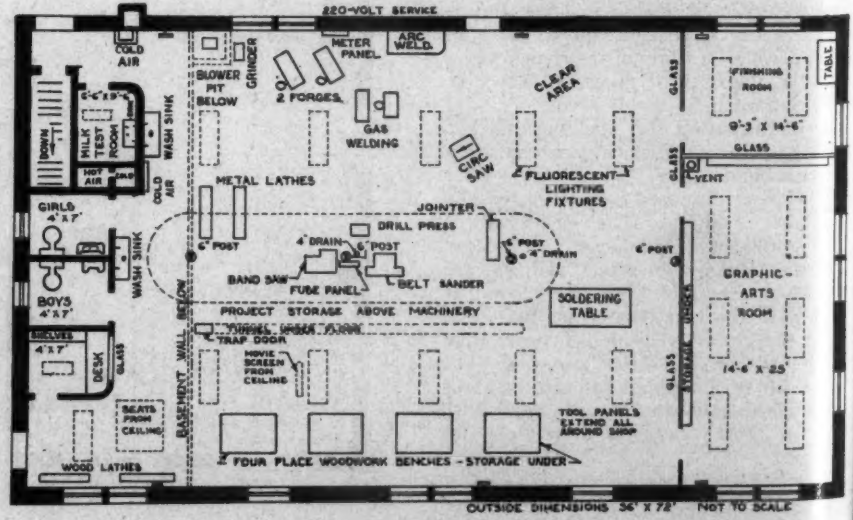
The writer began teaching in this shop in 1938 and soon found that the usefulness of the shop was greatly limited by the other uses to which it was put. The space factor was one that could not be overcome by any other means than the construction of an addition to the school building or the construction of a new building. Smoke from forging and welding operations and the noise from the hand and power tool work was carried throughout the school building, thus impairing study there.

Northwestern Wisconsin counties are relatively poor as the state's counties go. Farming is the main occupation and the farm land is not of the best. Because of the economic angle, an addition to the main building was the first thing considered. When this was found to be impracticable a separate building, with separate heating, ventilating, and plumbing facilities, was planned. The plans for this change were approved about August 18, 1941.

Actual construction began about September 25, 1941, and continued until the end of the school year.

The size of the new building is 36 ft. by 72 ft., with a 11-ft. ceiling. Three doors for pupil exit are provided and the large door is for machinery, etc.

The foundation of this building is of poured concrete, reinforced with steel and is waterproofed on the outside. The basement floor is of concrete as is the wall which forms the coalbin. The basement stairs and enclosing walls and overhead are also of poured concrete so there is a



*Formerly Instructor at Union Free High School, Frederic, Wis.

completely fireproof construction in this area. A metal-clad fire door closes the basement off from the grade level. It is planned that the wall and ceiling areas will be smooth plastered and painted later on.

The walls of the building are of 8-in. brick with nailing strips and blocks masoned in. Twelve-inch pilasters carry the load of the roof at four points along each of the side walls. The window sills poured in place and the pilaster caps and the coping above the roof level is of precast concrete.

The roof load is carried on 6- by 12-in. steel *I* beams of 18-ft. span. The beams meet at the center of the building and rest on plates and 6-in. pipe supports. The beams, capping plates, and posts are arc-welded where they join.

The ceiling joists run lengthwise of the building and are of 2 by 8 stock. The rafters are also of 2 by 8 stock and are spiked to tripled 2 by 8's which bear on the steel beams. The roof pitches to the center and two 4-in. cast-iron soil pipe drains are provided for the runoff. The runoff water is led under the floor and out the east wall. All rafters have a maximum span of 15 ft. and have two rows of bridging in this length.

The roof is of 3-ply built-up construction and is laid over 1 by 6 matched lumber. One 30-lb. felt and two 15-lb. felts are securely joined to make a durable roof. The flashing is of galvanized iron.

All wall surfaces and ceiling are insulated with ½-in. Insulite in the following colors: ceiling — 16 by 32 panels in an ivory tint; and the walls down to the tool panels are of random width, varigated colors ranging from a light gray to a rose color. Unfinished Insulite was used behind the tool panels.

The tool panels extend from the floor upward for 5½ ft. This area extends all around the shop and is made up of 1 by 6 white pine which has been chamfered on both edges to give a *V* joint appearance. The joints are vertical and correspond to the Insulite above. The pine is finished natural.

Steel, 12 lite sash are used for admitting light to the building. Glazing has been done with double-strength glass, metal clips and has been back-puttied. A commercial glazing compound has been used on the inside. Light is admitted from both sides of the building and from the east end. The state of Wisconsin requires that ⅛ of the floor area be in glass and this has been exceeded in this case.

Heating and ventilating is accomplished by means of a Mueller hot air furnace and filter-blower unit. Venting is done at two locations in the building and adequately takes care of requirements. Stoker heat is contemplated for the future.

Wiring is of approved type and provides 110- and 220-volt outlets wherever needed. Plenty of wall outlets are provided and welding and power toolboxes are numerous. All boxes are placed so that they are easily located. Fluorescent lighting fixtures have been installed over the main floor and incandescent fixtures are placed in the toilet rooms and the basement. There are 6 100-watt fixtures for the graphic-arts room alone. Fixtures over the main floor area are 8 ft. 6 in. from the floor. The fixtures are of the industrial type and are easy to keep clean.

Plumbing installations provide for two toilet rooms, a milk testing room, and two wash sinks in the main shop room. Toilet facilities are provided for both boys and girls because both use the building.

The shop has floors of two types, namely, concrete and wood. A wood floor is provided where edged tools are likely to be dropped. Planes, etc., are not as easily broken on a wood floor as a concrete one. The all concrete floor is 4 in. thick while the wood floor is laid on 2 by 2 stringers. A layer of 30-lb. building paper separates the rough and the finish floor. The 2 by 2 stringers are imbedded in a 3-in. concrete slab.

A tunnel was provided so that wiring connections could be easily reached and also so that a dust-collecting system could be installed later. The tunnel is of concrete and has a trap door that leads to it. All dust collecting leads have been run as far as the tunnel.

A special pit has been provided for a suction fan and motor for the smoke-collection system that will remove welding and forge smoke. This pit is finished except for the floor which will be put in when the fan and the motor are available.

A small office has been provided so that there will be a place to store books, magazines, job sheets, etc. A sound motion-picture machine will be installed in the office for the showing of educational films. A telephone has been installed in the office.

Project storage racks will be installed on the steel posts in the center of the shop and will be high enough so the students can work under them. Benches with storage facilities in them are contemplated. Wherever any machines lend themselves to the storage of parts, etc., they will be used for that job.

The accompanying floor plan layout shows an area marked out for seats that would be used for motion pictures, demonstrations, or lectures. At the present time no work has been done on this item. It is possible that the seats would be hung from the ceiling and would be pulled out of the way when not in use.

After most of the outside work had been done, and the building enclosed, the heating plant was placed in operation and the pouring of the inside concrete flooring was started. By the time that the concrete had hardened, the old shop was vacated and the classes were conducted in the new building. Moving day was about April 15, 1942. From this time on, any additional work that was done was accomplished by private contractors, by the faculty, or the students.

Even though a great deal has been done on the building, there is still a lot more that will have to be accomplished before the building can be put to its full use.

Special mention should be made of the interest shown by our principal, R. P. Glynn, who not only was an ardent supporter and booster for the new building, but also helped with the glazing, the mixing of the concrete for the floor, and also showed much ability with the hammer when the time came to lay the hardwood floor. All of these tasks are a far cry from the teaching of bookkeeping, but Mr. Glynn bridged the gap, and did it well.

What are the aims for the future? Considering the size of the school, the people who support it, and the fact that all of the students will not go back to the farm after graduation, it may be assumed that the same general aims held important before the new shop was conceived will still hold true. In short, general education and avocational aims should be the main considerations. Frederic is too small to have a vocational school, but people might be interested in evening school classes. Then, too, the school shop could very well be used by other groups of the community such as the Boy Scouts, or the like.

What to teach? The continued instruction of hand-tool processes first, followed by machine work seems to hold true for the future. The graduates of the school will rarely have a shop accessible that is well equipped with power machines, so they will have to be able to do hand work, and do it well.

The continued use of projects as a teaching aid should be important, but another idea may well be adopted. I refer to the construction of small power tools for the farm workshop. If a student could follow the construction of a small table saw from the drawing to the finished product, he would have experienced a lot more than if he bought the same tool at a hardware store.

Graphic arts should be developed so that any student can sketch out ideas and make and read simple drawings. The field of graphic arts is wide and a little of some of the component parts will round out the students' background.

In order that co-ordination between the departments of the school be assured, a very intensive study should be made so there will be no overlapping of emphasis by the various classes which a student may take during his four-year high school education. This can be done if the instructors can get together and really try to iron out the situation.

Industrial arts for everyone for a semester? That is something for the future to work out. Only time can tell if that is possible.

What lies ahead? The knowledge gained from eight years of industrial arts, the construction of a new building, a few ideas from outside sources, and a look to the future can all contribute to the essentials of a well-rounded industrial-arts program for the Union Free High School, Frederic, Wis.

Electrical Maintenance in School Buildings*

FRED D. MOSHER**

In general orderly maintenance consists of regular inspection of apparatus to determine its condition, routine maintenance work such as cleaning, oiling, and adjustment, and scheduling of overhaul at a time when the apparatus may be made available for a thorough job.

The electrical apparatus of school buildings lends itself to efficient maintenance practice, and a little study of the problem will show that the prime requirements of good care are easily met. More than casual study must be given to electrical maintenance problems in these times. Repair facilities are heavily strained, and the possibilities of immediate replacement are slender, and will become more so with time.

Inspections

How often a particular piece of equipment is inspected will depend, to a certain degree, on the kind of service in which it is operated, importance of the equipment to the functioning of the plant, and the nature of service as to the length of time it must operate in a given period. School service is not considered severe, but good reliability must be maintained.

For both a.c. and d.c. motors operated in school buildings inspections should be made weekly, semiannually, and annually.

Weekly inspections should note the conditions of the following: commutators, brushes, oil levels, oil rings, oil leakage, starters, controls, temperature. Careful attention to sparking will prevent burnouts in many cases. To check operation the motor should be stopped and started, and the time required to come up to speed should be observed. If the motor lags in this respect a careful examination should be made to determine the reason.

Semiannually, each motor should have a more careful check, and routine maintenance work should be done at this time.

The condition of windings should be checked for dirt. If sticky accumulations are found, they should be removed with cloth dampened with solvent. If the dirt is of the dry variety, the coils should be blown out with dry compressed air. The commutator clamping ring of each motor should be examined for tightness. Brush renewals should be made whenever brushes are found to be more than half worn; brush holders should be cleaned; brushes should be held free in the holders; brush pressure should be checked; the correct position should be maintained with respect to brushes.

*Reprinted from the May, 1943, issue of *American School Board Journal*.

**Erie, Pa.

Each six months the oil should be drained from all bearings. The bearings must be flushed out and thoroughly cleaned before new oil is added. Inspection should be made on roller bearings or ball bearings to determine the amount of grease held. When adding grease to these bearings, the bearings must be properly vented to prevent damage from overpressure applied by the grease guns.

At the semiannual inspection it is important to note the condition of all connections on motors and controls. Contact surfaces should be polished and causes of sparking or arcing ought to be removed. Check the shaft for end play. Motor covers, guards for belts or gears should be examined for looseness. Setscrews, foot bolts, end-shield bolts, and support brackets should be inspected for broken parts.

After the motor has been inspected, cleaned, and serviced it should be operated for observation. At this time it is advisable to operate the motor at no load and full load to check its characteristics. Speed readings should be taken under both conditions, as should the current input. The motor should run smoothly and without vibration. Any evidences of sparking at the commutator should be reason for investigation. A properly operating belt or chain will make for normal operation; belts and chains should be kept at the recommended tensions for smooth operation and efficiency.

The once-a-year inspection and overhaul should cover the following points: inspection of armature coils and armature bands; testing of insulation with megohmmeter; measuring of air gap; cleaning of magnetic dirt from poles; checking clearances of sleeve bearings; checking commutator slots.

Important Maintenance Items

Lubrication. Most motors do not require renewal of oil at periods more frequent than six months. Oil should never be added to the reservoirs unless the oiling system itself is in good order. Oil rings must be kept in good condition. Excessive oil is undesirable since it will be thrown into the windings where it will act as a catcher for dirt. For best results from lubricant keep the bearings in alignment, and correct wear at the first opportunity. Use only high-grade oil as recommended by the equipment manufacturer. Large motors equipped with sight glasses should carry oil levels at three quarters of the glass. Small motors not equipped with glasses should get a maximum of 70 drops of high grade oil yearly, but not less than half this amount.

Motors equipped with ball or roller bearings should be refilled with new grease annually without regard for the condition of the grease; very seldom do operating conditions necessitate more frequent renewals. Vented housings should be filled with grease from a hand-operated grease gun. Add grease until it begins to run from the vent; run the motor until excess grease stops running from the vent and then replace the plug. Where no vents are provided different steps must be taken to renew the grease.

If vents and grease gun fittings are not provided, it is necessary to disassemble the bearings. All old grease must be removed and the bearings washed in a solvent such as carbon tetrachloride. Grease is then put in the bearing by hand until it is firmly packed at half level in the bearing, or less if instructions specify a smaller quantity of grease.

Care of Insulation. Next in importance to proper lubrication is the care of insulation. The two chief enemies of motor insulation are dirt and moisture. When it is necessary to clean insulation, care must be taken not to soak the windings with cleaning solution. Damp cloths may be used if the cleaning fluid used evaporates rapidly, such as carbon tetrachloride. Use dry rags wherever possible. When compressed air is used it should be dry; vacuum cleaning is better than compressed air for the removal of loose dirt.

Moisture usually is not a problem unless motors are kept idle for extended periods; this often occurs in school buildings. For high voltage motors driving heavy equipment, the most effective drying method is to pass low-voltage current through the windings. When this is done thermometers should be placed in the windings to read temperature. In no case should the windings be heated above 200° F. while being dried out. Small motors which are easily removed from their bases may be dried in ovens where the temperature can be controlled. About eight hours are required to dry out the average motor, and half this time suffices for units of small size. Where a motor has been subjected to severe dampness it should be treated with a good varnish after drying. Large motors may have the varnish applied with a spray gun or brush. Small motors may be dipped in the protective coating. Excess varnish is then removed from the metal parts with a solvent, and the motor is again baked for from four to eight hours.

General Overhauling. When a motor is overhauled particular attention should be given to its vital points. The air gap space will tell a story, and it should be checked carefully with feelers; too little clearance

on the bottom might indicate a worn bearing.

Bearing and journal dimensions should be checked for wear. If new bearings are installed they should be watched carefully during the first days of operation. Some of the things new bearings might do are: throw oil or grease into windings; run hot because of too little clearance; overheat motor because of excessive friction.

Brushes are important elements in motor maintenance. When they are neglected brushes may cause considerable expense and damage. It is good practice to keep spare brushes on hand, and replace worn ones as soon as they become more than 50 per cent worn. A badly worn brush may break and damage the commutator or wear to the point where metal rubs the commutator to score it. Large motors should have a brush pressure of 2 to 2½ pounds per square inch on the commutator; higher pressures may cause sparking, overheating, and ultimate damage.

Commutators should be treated with great care. Replacements are next to impossible. When a commutator sparks the cause should be run to earth and removed. When commutators are inspected all rough spots should be noted and removed. A generally roughened condition may require stoning for removal. Excessive roughness is best removed by turning down in a lathe; when lathe work is done on a motor the insulating bars should be undercut before returning to service. Either a stone or sandpaper should be used for smoothing commutator surfaces — emery cloth should not be used.

Care of Idle Motors. An idle motor should be stored in a dry condition. It should be properly cleaned before storage. Where moisture is likely to get into the windings, heat should be provided. A waterproof covering should protect all motors exposed to moisture or water from any source. All motors should be covered to prevent dirt from accumulating on coils and windings. When it is necessary to provide heat for an idle motor, the covering should be vented to allow vapor to pass off. Renewal of lubricant should be done after the idle period. A thorough inspection should be made of the stored motor before it is returned to service.

Sound Control in the Industrial-Arts Laboratory

C. W. JOHNSON*

The problem of treating an industrial-arts laboratory for sound control is much different than that of treating a large auditorium or radio station. In the industrial-arts laboratory the main consideration is in keeping the intensity of the sound produced by the activities of the students down to a point where ordinary conversation can be heard without difficulty, and to keep the noise emanating from the room from disturbing the students in the adjoining classrooms.

To discuss the subject of noise reduction, it is necessary that some mention be made of the general behavior of sound. When sound is made in a room, sound waves spread from the source at a speed of approximately 1100 feet per second. They very quickly strike the interior surfaces of the room and are partially reflected and partially absorbed. Since most building materials, such as glass, plaster, wood, etc., reflect over 95 per cent of the sound energy that strikes them, sound waves continue to be reflected hundreds of times before enough of the energy is absorbed to make the sound inaudible.

When a continuous sound is made in a room with high reflecting surfaces, these reflections tend to build up the sound intensity to a point much greater than would result from the same source without reflection. If some of these surfaces are made absorbent, the reflections from them are much reduced, and consequently the total intensity attains a lower level than before.

This action is directly analogous to the case in illumination in which, without changing the light source, the light intensity may be greatly increased by the use of white surfaces (light reflecting) and decreased if some of them are painted black (light absorbing).

It has become common engineering practice to state the quieting effect of treatment in a given room in terms of the reduction of the noise level in decibels or simply as a so-called *decibel reduction*. The decibel (db.) is a logarithmic unit of sound intensity adopted for convenience in handling the extremely large range of intensities which the human ear is capable of hearing. Sound intensities when stated in decibels are referred to as *intensity levels* or, in the case of noise, as *noise levels*.

An intensity of 0 db. corresponds to the physical intensity of a sound just too faint to be heard by the human ear. A level of 10 db. corresponds to 10 times the original intensity, 20 db. to 100 times the original, 30 db. to 1000; and so on. An increase of 1 db. in intensity level corresponds to an increase of 26 per cent in intensity and a decrease of 1 db. to a decrease of 21 per cent in intensity. The highest intensity level which the ear can receive without actually feeling pain is about 120 db. which corresponds to an intensity one trillion times the original.

Reference to the loudness scale makes a 5- or even 10-db. reduction seem small to be obtained by so much absorption. Practical experience, however, shows that reducing the loudness of noise in an office or factory by 5 db., at the average loudness level, causes a very appreciable decrease in annoyance, and seems to be about the minimum reduction which should be attempted. Because of the expense involved it usually is not practical to attempt a reduction greater than 10 db.

The explanation of the fact that a comparatively small decibel reduction produces a very substantial quieting effect lies in the manner in which the ear estimates reduction in loudness. The psychological sensation of loudness does not correspond directly to intensity level in decibels, but follows a rather complicated relation. For example, if a sound is reduced by only 6 db. it will be estimated as a reduction in loudness of 30 to 45 per cent, depending on the original level of the sound. This relation is shown in the chart shown in Figure 1.

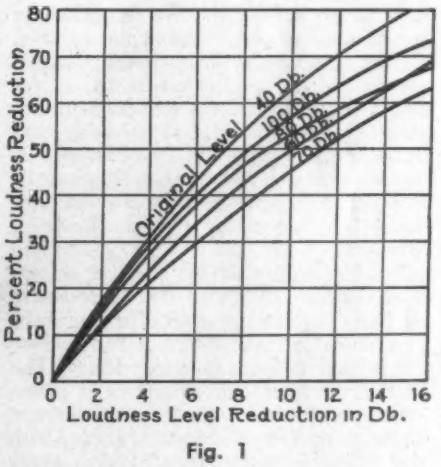


Fig. 1

When contemplating acoustical materials that could be used as a means of quieting an industrial-arts laboratory, cer-

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tain requirements must be set up before any products can be chosen. These requirements are listed and very briefly discussed in the following paragraphs.

1. It cannot be too expensive. Costs of education are heavy, and any installation contemplated must not involve an expense greatly above that of ordinary treatment.

2. It must be fire resistant or noncombustible. The danger of fire is an ever present and greatly feared one in any school; because of this, any material used in the acoustical treatment of the building should, therefore, reduce this danger by being fireproof.

3. It must be vermin proof. The presence of vermin is always accompanied by an increased danger of disease, and in a school this danger becomes doubly important. The building materials used, therefore, must be of such a nature as to repel or keep out vermin.

4. It must be readily cleaned or painted without losing more than 5 per cent of its efficiency.

5. It must have a good, yet glareless light reflecting factor. The expense of lighting is always a large one for any school, therefore it would be doubly expensive if it added to the expense and difficulty in obtaining adequate lighting.

6. It must have a high standard of absorption of sound for the life of the building. Acoustical installations depend upon the interstices within the material, therefore the wall strength of the *cells* must be sufficient to support it without packing down, sagging, or collapsing in a manner that would result in distinct loss in efficiency of sound absorption.

7. It must present a pleasing surface and be readily adaptable to the decorative effect desired.

8. The surface of the product must not be so soft as to be easily damaged by casual contacts with lumber or the like.

9. It must not blister or sag if exposed to long applications of heat, such as behind or above a radiator.

10. It must be of such a nature that it can be applied over existing walls and ceilings.

11. It must possess a noise reduction coefficient of at least 60 per cent, at frequencies ranging from 256 cycles to 2048 cycles.

The manufacturers have, of course, realized the needs that visible acoustical treatment must meet, and have to a large degree met all of these requirements. The greatest per cent of rejection of a product is met by two items, the loss of efficiency due to painting because it cannot be cleaned effectively, and the high standard of noise reduction coefficient desired — that of 60 per cent.

Student Patrol and Court System for Vocational Schools

FRANCIS J. COYTE*

Connelley Vocational High School has tried out several student patrol and patrol court systems over a period of years, and has accepted its present shop-unit safety patrol and related-academic homeroom jury panel as one of the most practical methods of supervising corridor traffic safety, and handling of disciplinary problems associated with this activity. A well-organized student patrol and patrol court will eliminate a large share of direct faculty discipline and should develop student initiative in self-control. We recognize the fact that the primary purpose and function of the student patrol is preventative in nature, and the specific function of a student court is to effect a reduction in student offenders, rather than stressing control through fear and punishment. A successful patrol and court system can be achieved if they are supported by the students, faculty, and by the school administration.

Leading authorities on student council activities have estimated that there are as many as 14 different types of student self-government organizations, all of which place good citizenship and self-discipline as their number one objective. It is encouraging to know that students desire an active part in self-government, and with the proper encouragement and support from their fellow students can achieve their goal.

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A recent survey of student councils and student courts in the high schools of Pennsylvania reveals the fact that 60 per cent of the schools have student councils, and 10 per cent of this group is properly organized to accept the responsibilities of dealing intelligently with offenders through a school court, as well as in other activities. Unfortunately, some few writers claim that the movement for greater participation in school government was instituted in order to make discipline easier, and thereby relieve the principal and teachers of many details. True, the primary nature of pupil participation in school government is to furnish educational experiences which will be of value to the young people, but with it must go real and genuine responsibilities for which they must be held accountable to the school authority who delegated these privileges; otherwise they will fail to accept their responsibilities in a democracy. Such qualities as the spirit of fair play, respect for the rights of others, self-control, self-direction, self-respect, and integrity, are not necessarily developed by formal memorization of the textbook material on the subject, but by learning to do them through actual practice. To provide a broad experience and participation in school government does not necessarily lessen faculty responsibility. On the contrary, faculty participation and association with student activities increases in proportion to the expansion of the program and provides many opportunities for sympathetic guidance. We do not claim that the system described in this article is the answer to all school situations, but we do know that, after more than 12 years of successful operation, the students alone cannot carry out their good intentions without the active support of each and every faculty member.

Contrary to the general practice of selective student participation and limited adult supervision, we encourage school-wide student participation in school government and rotation of faculty supervision, thereby equalizing the responsibility of enforcing school safety regulations and discipline in our school. Two natural divisions of vocational school organizations make it possible to schedule safety patrol units for corridor and exit duty from the shop departments, and to select jurymen for patrol duty from the home-room groups, thereby assuming combined responsibility for school government. Our student government enlists the cooperation of the shop departments in addition to the home room, thereby utilizing our strongest units of student interest to support the student council and take over one of the more difficult phases of school government, namely, patrol duty and the apprehension of violators.

Opportunities for democratic leadership are not alone limited to the home-room and student council activities. Each shop patrol group selects its own leaders, which compares favorably with the positions held

by elected home-room officers. These two areas of student participation afford additional opportunities to develop leadership capacities, while those not sufficiently experienced should learn through intelligent cooperative followership.

Discipline within large departmentalized school buildings having combination, or separate shop and academic units, present an added responsibility of supervision during lunch periods, during assemblies, and at dismissal time. Connelley Vocational High School, being a centrally located shop plant and academic-related building, is a self-contained unit with traffic through the academic building to the cafeteria, and to the auditorium for noon movies and assemblies. Students are not permitted to leave the building during school hours. Two lunch periods, and two noon recreational lunch periods, absorb the entire luncheon schedule.

The patrol groups are on duty throughout the school plant during the academic and shop lunch periods, during assemblies, and at dismissal time. They are held responsible for all student conduct in the corridors, stairways, toilets, and supervise main doorways and safety exits. This effective co-ordination of student patrol and patrol court has given our boys excellent experience in this phase of student government. Under this system, the shop departments vie for the honor of being selected the best patrol group each semester. Selection is based on the decision of student council, and with the final approval of the school principal.

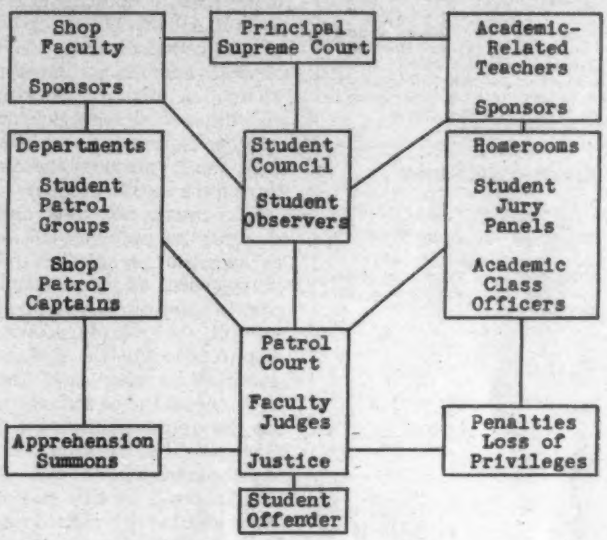
Co-ordinated Patrol and Patrol Court System

The organization chart of the Connelley Vocational High School co-ordinated patrol and patrol court system shows the two areas from which the patrol groups and jury panels are chosen. The line of authority and responsibility is clearly revealed for student body and faculty alike. The complete interchange of the shop and academic sections, alternate weeks, equalizes pupil participation and responsibilities. Opportunities for leadership and cooperative followership are also given equal emphasis in both areas.

Connelley Vocational High School is a centrally located combination shop plant and five-story academic-related building, housing 1600 students on a week-about schedule. Students remain in the building during school hours, and limited lunch passes are issued to local students, living within a half mile of the school. The cafeteria and auditorium each seat half the school enrollment at one time. Two lunch periods, and two ten-minute noon movie recreational periods absorb the entire lunch schedule. Internal traffic up five floors to the cafeteria, and down five to seven floors to the auditorium and gymnasium sides of the building, also seven exits on five different levels, necessitate a large vigilant safety patrol during the lunch, movie, and assembly periods.

Shop-Unit Patrol System

Our present organization is so planned to distribute the safety patrol responsibilities among twenty shop units, who accept the assignment for a period of two weeks each semester. Under the week-about shop-related plan, the odd and even designated groups interchange each week, thus providing a new group of boys for the second week of patrol duty, thereby permitting all students from each department to participate. In actual operation, two shop groups, comprised of approximately fifty to sixty boys, are necessary to properly supervise all halls, stairways, landings, toilets, gymnasium, auditorium, and main exits during lunch periods, assemblies, and at dismissal time. Each pair of shop instructors selected for patrol duty supervise their respective patrol groups and retain the assignment for a period of two weeks, using odd- and even-designated groups during alternate weeks. Shop groups selected for patrol duty receive notice of schedule assignments through the daily bulletin and public-address system. Patrol groups are scheduled to report to the patrol courtroom at 10:00 a.m. Monday morning, approximately one half-hour after court convenes, to observe the court in action for the remaining half-hour of court schedule. During this period of observation, the patrolmen see the results of their effort; that the court depends on their cooperation, and without it, student government would be a farce. Near the close of court session, three student council observers comment on the function and need for enforced regulations. This recognition also brings student council members into active participation in the conduct of the court. Following the formal closing of court, the presiding judge brings to the attention of the new patrolmen proper procedures in the filling out of patrol summons and correct information so as to expedite court procedure, such as: correct names, nature of violation, school address, grade section, shop section, time, witnesses, and patrol post. The summons is made out in duplicate form — one part is given to the boy, and the stub is sent to the court judge. The patrol pledge is then administered by the presiding judge to the patrol groups as the final closing of court.


Shop Faculty Sponsors
Principal Supreme Court
Academic-Related Teachers Sponsors
Departments Student Patrol Groups Shop Patrol Captains
Student Council Student Observers
Homerooms Student Jury Panels Academic Class Officers
Patrol Court Faculty Judges Justice
Apprehension Summons
Penalties Loss of Privileges
Student Offender

Organization chart

Patrolmen's Pledge

1. To be at my post on time.
2. To remain at my post during the entire time while on duty.
3. To be courteous but firm in the maintenance of good order.
4. To respect the authority and follow the instructions of the captain of patrol, the principal of the school, and of his representatives.
5. To maintain a high degree of scholarship in my school subjects, and to cultivate and hold the respect of my fellow students.
6. To be faithful in the discharge of my duties and the ideals of the Connelley Vocational High School.

At this point, the Activities Director takes over the meeting, and issues safety patrol arm bands, printed patrol summons, and mimeographed patrol assignment forms to the shop instructors. Before positions are assigned, the regular preliminary patrol routine is reviewed regarding the operation of the patrol which includes:

Courtesy, tolerance, tactfulness, dependability, punctuality, respect for school property, building cleanliness, school regulations, routing of hall traffic, timing of traffic on stairs, inspection of toilets and lockers, auditorium seating during noon movies and assemblies, sale of streetcar passes, sale of War Stamps, collection and return of lunch passes, regrouping of patrol during assemblies and at dismissal time.

Each patrolman is charged with the

PATROL COURT SUMMONS

Name of Patrolman..... Post.....

Name..... Date.....

Grade..... Rep. Room..... Shop.....

You are hereby summoned to appear before the Patrol Court in answer to a charge brought against you by a member of the Patrol Squad.

The charge.....

Report to Patrol Court Room at 8:50 a. m. at next Monday's Patrol Court Session. Present this ticket to the Judge. Failure to report at the above stated time will result in an additional charge of contempt of court. It is your privilege to bring to the hearing any member of the faculty you may choose.

This card to offender.

PATROL COURT SUMMONS

Name..... Date.....

Grade..... Rep. Room..... Shop.....

The charge.....

Patrolman to turn this stub in to Mr. Butler, Room 201, as soon as it is made out. Also he is to appear at the hearing when the case is called.

Name of Patrolman..... Post.....

Grade..... Rep. Room..... Shop.....

Shop Teacher.....

The summons

responsibility of enforcing the traffic rules and regulations entrusted to him as an officer. He has the authority to issue a patrol court summons to any student who does not conduct himself properly, or who does not obey the patrol rules at his post. Some of these offenses are as follows:

(1) Chasing another boy, (2) fighting, (3) horseplay, (4) smoking, (5) defacing school property, (6) eating in auditorium, (7) refusal to obey orders, (8) refusal to clean up at tables in cafeteria, (9) refusal to show corridor pass or building pass, (10) away without leave (AWOL), (11) neglect of duty, (12) illegal use of passes or activities ticket.

The patrolman is likewise held responsible for the authority entrusted to him and his conduct as a student patrolman. Definite instructions are given regarding the early patrol lunch period, patrol seating in cafeteria, patrol seating during special movies (third showing of noon movies), and issuance of patrol tickets to patrolmen for negligence of duty.

The appointed patrol captains toss for the choice of patroling the auditorium or gymnasium side of the building, which, for all practical purposes, divides the stairway exits and corridor assignments almost evenly. The shop instructors and captains make all position assignments before going to the cafeteria, which is scheduled for 11:00 a.m. Larger boys are placed at points of exit, and smaller boys on mid-landings, or paired with larger boys. Absence of one or more patrolmen in either unit can be adjusted by the shop teacher or appointed captains before reporting for duty. Shop teachers are required to eat with their boys, and are required to make routine checks and place themselves at vantage points as traffic conditions change. Shop teachers are also requested to rejoin their groups during the patrol movie period.

Preceding the special movie period for the patrolmen (patrolmen sit together as a combined unit) the activities director checks with the patrol groups for clearance of patrol tickets issued, lifting of unclaimed lunch passes, clearance of early dismissal forms, assignment of special roving patrols (if necessary) to round up cases of AWOL and check on locks, lockers, and corridor passes. The fact that this group reassembles for patrol movies at the termination of patrol duty affords an opportunity of clearing up any misunderstanding or wrong procedure, and a final check can be made on the combined activities of the patrol groups.

The amount of time and explanation necessary to patrol groups each Monday morning, and on successive daily meetings of the patrol at patrol movie time, varies with the age distribution and past experience of the patrol groups. Our present shop rotating patrol system has been in operation for years, and has proved itself to be one of the best methods of distributing the responsibility, and, at the same time, provides the shop competitive spirit to do a good job.

As a result of this cooperation of students and faculty alike, everyone becomes better acquainted with the problems, difficulties, and dynamic effort that must be expended to maintain a well-disciplined school.

Related-Academic Patrol Court

Our patrol court convenes every Monday morning at 9 o'clock in the patrol courtroom, at which time jurymen, drawn at random from name-card files, report to the court, and offenders are seated directly in front of the judge's bench. The court is presided over by two faculty judges — one from the academic-related section, the other from the shop departments — who cooperate with the activities director and are responsible to the school principal.

The patrol courtroom seats one hundred persons, and is equipped with seating space for two jury panels, large table, suitable furnishings, an abundance of bulletin board space on which live posters, safety placards, school mottoes, and suitable timely publicity is posted. A student court clerk keeps all court records. The importance of keeping records cannot be overemphasized. He must keep track of cases, and the disposition of them; keep in touch with repeaters; compile statistics which show just what the several offenses are; to summarize the number of cases handled, and to use the records as a follow-up in carrying out the penalties of the court.

The selection and announcement of jury members and student council observers is presented over the public-address system to the academic building at 8:35 a.m. by the associate judge, following the devotional exercises and reading of the activities bulletin. These names are drawn at random from one of two complete name-card files, each representing one half of the student body, known as the odd and even sections. Jurymen and student council observers are drawn from the card file corresponding with the academic schedule. Jury members serve once in a given semester. Approximately fifty home-room presidents are called upon during the semester to attend court sessions and comment on the proceedings of the court in the presence of the entire assembly of jurymen, patrolmen, and offenders. As a result of this direct participation of student council members, many fine suggestions and recommendations have been made by the student council for the improvement of school self-government.

Order of Procedure:

I. Court is called to order by presiding judge.

II. The roll call of offenders and of the patrolmen who issued the patrol summons is made by the court clerk.

III. The judge now swears in the jury panels and explains the following important points to the jury:
   A. Any member of the jury may be excused if a case comes up wherein he may be prejudiced.
   B. The purpose of the jury is to see that justice is properly meted out,

Patrol court stage assembly program

keeping in mind that the patrol court is acting for the safety and welfare of the entire school. If the defendant is innocent, he should be acquitted; if he is found guilty, a proper punishment should be suggested.

C. *Examples of Sentences:*
   1. Smoking — 10 afternoons
   2. AWOL — 5 afternoons

D. A foreman of each of the two juries is selected, and to them the following items are explained:
   1. Each member of the jury is asked to vote guilty or not guilty, and the majority vote will decide the verdict.
   2. If the defendant is guilty, they recommend a suitable punishment, and the foreman acts under the direction of the majority.

IV. Trial of cases.

A. The judge swears in the patrolmen who present testimony.

B. The judge puts the defendant under oath to tell the truth and instructs him to lay his case before the jury.

C. Testimony of witnesses:
   1. Teachers may testify only when requested by the court.
   2. The prosecutors.
   3. The defendants.

D. Questions by members of the jury are allowed.

E. Final cross examination by the judge and charge to the jury. (Tactful handling of cases by the faculty judge in bringing out important facts and information during the trial of offenders is carried out in a sportsmanlike manner.)
   1. The verict of the jury becomes final only with the pronouncement of the presiding judge, and is rarely altered. (Experience has proved that student juries are not as lenient as one may surmise.)
   2. The court may dismiss the case for lack of evidence.
   3. If the defendant is innocent, he should be acquitted.
   4. The jury may suggest any reasonable punishment to fit the case:
      a) Reprimand or warning.
      b) Essays on conduct or safety.
      c) Apologies to the person or persons wronged.
      d) Shop cleanup crews.
      e) Suspended sentence.
      f) Third offenders may be suspended by the supreme court.
   5. If the judge has reasonable doubt that miscarriage of justice has occurred, he may dismiss the offending jurors, and, if necessary, substitute an entire new jury. Not all offenders are convicted, and those that feel that penalties imposed are unjust may appeal their case to the principal who sits, informally, as supreme court judge. These cases are reviewed in the principal's office.
   6. The jury retires to consider a verdict.
   7. The foreman reads the verdict.
   8. Sentence is passed on the defendant, and he is instructed as to when and in what manner it is to be executed. If the defendant fails to report or serve consecutively, he is held in contempt of court, and the number of days he misses will be doubled, or he may be brought before the court on this charge.
   9. The defendant has the right of appeal. To do this, he must arrange for a trial before the supreme justice (principal) before school-closing time.
   10. If, for any reason, the judge doubts the fairness of the verdict, he may ask the individual jurors as to how they reached a decision, or he may simply take a poll of the jury.
   11. The clerk now makes a record of the disposition of the case, and the following case is called.
   12. Special preference is given to cases of long standing, or at times when a boy may be needed in shop or classroom.
   13. Postponements:
       In cases wherein all the evidence cannot be brought out, due to the absence of one of the interested parties, a postponement is granted by the court.
   14. If the docket is not cleared at the time set for adjournment of court, the remaining cases are postponed until the next session of court, and the persons interested must appear without further notice.
   15. It is the duty of the associate judge to see that good order prevails in the court, and that no juror is prejudiced or swayed in his decision by outside influence. Such violations of conduct should be presented with a ticket for contempt of court.

V. The presiding judge thanks the jury for its services and may comment on the nature of the verdicts.

VI. Announcements or explanations are made to the patrol groups.

VII. The patrol pledge is administered by the presiding judge.

VIII. Court records are dispatched to the proper places.

IX. Court is dismissed.

Student council stage assembly program

How to Make Penalties Stick

Student offenders who fail to appear in court on Monday morning are brought into the patrol court by the patrol captains, and additional penalties are imposed for ignoring the summons. Students failing to complete penalty assignments receive *U* (unsatisfactory) grades in citizenship, and are automatically referred to the counselor and supreme court, and disciplined if the situation warrants. Discipline cases within shop or classroom involving teacher-pupil relationships do not come to the attention of the patrol court.

Students receiving *U* grades in citizenship do not have this grade raised until all penalties have been completed. This is one of the most effective methods of enforcing school regulations, and assures cooperation with the student government.

Follow-up of court cases consists of checking on those students who receive penalty assignments and lifting of *U* grades in citizenship during the report periods if all penalties or loss of privileges have been satisfied.

Observations and Conclusions

The inspiration to write this article about our patrol and patrol court system was prompted by the enthusiastic response from our senior groups to the following question: "What do you consider to be one of the important things about our

school that should be brought to the attention of new students entering this school?" The answer invariably was, "Tell them about our patrol and patrol court." As a result of this constructive suggestion and subsequent confirmation of student opinion, a second *new-boy* assembly has been included in the activities program featuring the patrol and patrol court on the auditorium stage.

We have observed that many pupils failing in citizenship traits respond more readily to correction from the court than to correction from teacher or teachers, as the case may be.

This school believes that one important way in which students learn the obligations of democratic citizenship is by assuming responsibility for making regulations governing their own conduct through a representative body, and for the observance of these regulations.

There has been a tendency in many schools for positions of leadership to be held by a few students — far fewer than would be justified by differences in leadership capacities. Because the selection and use of leaders is so important in a democracy, teachers need to give special attention to these processes in schools. Each student should have opportunity to develop his distinctive leadership capacities. Those not in a position of leadership should learn through practice the skills of intelligent cooperative followership.

Past experience has proved that a permanent patrol group made up of selected patrolmen, representing all shop departments, do not cooperate as effectively, lose excessive shop time in relation to their classmates, and become decreasingly effective as weeks go by, necessitating constant change of personnel. This scattered location of patrolmen, and lack of unity under previous arrangements, proved unsatisfactory. Our present shop-rotating-patrol system has been in operation for years, and has proved itself to be one of the best methods of distributing the responsibility, and at the same time, provides an incentive to do a good job.

A school in which courses of study, classroom teaching, and student activities all contribute to a better understanding of democracy, and give actual practice in how it works, is a school for democratic citizenship. Such a school reflects, through administrative policies, the faith in democratic efficiency which it hopes to give its students.

Student Patrol — Instructions and Rules

The shop-rotations patrol system herein outlined was introduced in September, 1935, and operates on the principle that every student must contribute a small part of his school time in the maintenance of an orderly school plant.

As the rotating patrol system progressively advances from one shop to another the entire student body becomes more familiar with the problems of protecting the rights of others, protecting school property, and the function of the patrol court.

Patrol Committee	Student Government Committee
Mr. D. C. Ellinger, Judge of Court of Appeal	1. Mr. D. C. Ellinger, Prin.
	2. Mr. J. D. Fog, Vice-Prin.
Mr. F. J. Coyte, Director of Activities	3. Mr. J. S. Loar
	4. Mr. E. G. Emerson
Judges of Patrol Court	5. Mr. E. E. Ohlson
Mr. W. B. Butler	6. Mr. B. J. Eggert
Mr. A. C. McCollum	7. Mr. I. L. Spear
Associate Judges	8. Mr. R. A. Zartman
Instructors in charge of Patrol Squads	

Two complete shop groups are scheduled to manage the 42 patrol positions scattered throughout the building. The school plant is divided for convenience into two patrol units known as the East unit on the gymnasium side of the building (odd numbered posts) and the West unit on the auditorium side (even numbered posts).

The East unit requires 23 patrolmen and the West unit 31 patrolmen. The distribution is as follows: 1 captain, 1 lieutenant, 13 single posts and 4 double posts — a total of 23 boys — for the East unit. The West unit requires 1 captain, 1 lieutenant, 17 single posts, and 6 double posts — a total of 31 boys.

It has been found advantageous to assign one shop group to the East side and the other to the West side of the building. Due to the fact that the West unit requires extra patrolmen, the shop group composed of the larger number of boys is usually assigned to the West side and smaller of the two, to the East side. If the older group is assigned to the West unit (auditorium side), adjustments can be then made by substituting patrolmen from the East to the West unit when necessary.

Duties of Shop Instructors: The shop instructor will select a captain and a lieutenant from among his students capable of receiving the respect of all patrolmen in his charge and whose outstanding initiative and ability qualify him for the job. The captain may assist the instructor in assigning the larger and more experienced boys to the main exits and doorways. The captain may shift his men if absence occurs and may reinforce troublesome positions if necessary. The captain must report inefficient and disloyal patrolmen to his shop instructor before court action may be recommended. The shop instructor (1) selects one captain and one lieutenant; (2) selects patrolmen with assistance of captain; (3) explains procedure in issuing a patrol summons to an offender; (4) dispatches patrol to patrol court at 10:00 (see daily bulletin); (5) dispatches patrol to cafeteria at 11:00; (6) dispatches patrol to movies at 12:45; (7) dispatches patrol to all assemblies (see daily bulletin); and (8) dispatches patrol to posts at 3:00.

He inspects the patrol unit when they come from the cafeteria and assists in the shop corridor at 12:00, and remains in charge until shops go to lunch at 12:06. He makes any changes that will improve his patrol group and all final decisions regarding inefficient patrolmen rest with him. He appears in the patrol court with his patrolmen and assumes the office of associate judge. He is permitted to excuse any of his students for early lunch periods so that they can return at 11:20 for patrol duty. He reports to the cafeteria stairway (5th floor) at 12:25 and remains in charge until 12:40. All shop boys must remain on duty until 12:40.

PATROL REPORT SHEET SENT TO SHOP INSTRUCTORS

Instructor_____ Date_____ Shop_____

Captain must make the rounds of his posts and check report.

L -- Lunch
D -- Dismissal
* -- Important Posts

This report must be turned into the office Friday of this week.

	Odd	Even	Mon. L	Mon. D	Tues. L	Tues. D	Wed. L	Wed. D	Thurs. L	Thurs. D	Fri. L	Fri. D	ASSEMBLY
Academic													
Captain	*	*											
Lieutenant	*	*											
5th Floor	*31	32*		No		No	No		No		No		
Cafeteria	*31	32*		No		No	No		No		No		
Landing	29	30		No		No	No		No		No		
4th Floor	27	28											
Landing	17	18											
3rd Floor	23	24											
Landing	21	22											
2nd Floor	19	20*											
	19	20*											
Landing	17	18											
Office and Shop Corridor Main Floor													
Office	3*	4*											
Floor	3*	4*											
Shop Toilets	7	8											
Shop Corridor Exits	11	No											
Rear Auditorium Balcony	No	36		No		No	No		No		No		
Auditorium Balcony	No	38*		No		No	No		No		No		
Doors	No	38*		No		No	No		No		No		
Main Front Exits and Stairways Below Office Floor													
1st Landing	15	10											
2nd Sub-land	13	14											
Center Main Exit	*0	No											
	*0	No											
Front Main Exits	*1	2*											
	*1	2*											
Main Auditorium and Gymnasium Entrances													
Rear Auditorium Doors	No	34*		No		No	No		No		No		
Auditorium		40*		No		No	No		No		No		
Main Doors	No	40*		No		No	No		No		No		
Gymnasium Entrance	*9	No											
Sub-Floors Exits and Corridor													
Bridge	No	42*											
Annex	No	12											
Brick Exit	No	16*											

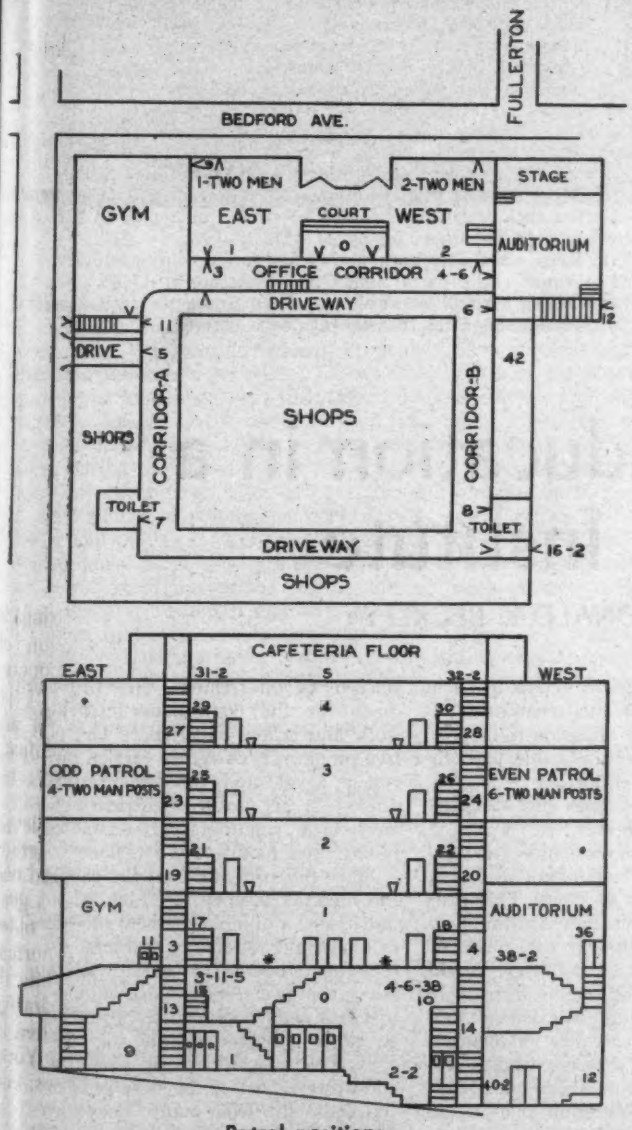
Patrol report sheet

Duties of the captain: (1) Helps instructor assigning patrolmen; (2) enters names on daily tabulation form; (3) gives out official typewritten instructions to patrolmen; (4) rechecks lieutenant on distribution of belts; (5) dispatches men to posts at 11:25; (6) checks all posts at 11:25; (7) reassigns men if any absences occur; (8) dispatches group to patrol movies at 12:45; (9) rechecks positions at 3:05; (10) gives out two new patrol tickets to patrolmen each Monday; (11) takes up official positions in office corridor when inspection rounds have been made; (12) receives patrol summons from patrolmen and delivers them to Mr. Butler; (13) assists any patrolmen in trouble; (14) has charge of his patrol group at major basketball games when large crowds are expected; and (15) receives overtime lunch passes (West) and deposits them in No. 7 mailbox.

After the captain makes his rounds he should so time his movements so that he can be in the following (peak load) to help other patrolmen.

No. 3 (East)	*No. 4 (West)*
Shop corridor 11:55	2nd floor 11:45
Shop line-up 12:00	Shop corridor 11:55
Release shops to cafeteria 12:06	Shop line-up 12:00
Block shop corridor (A) 12:15	Auditorium 12:00
	Release shops to cafeteria 12:06 to 12:10
	Block shop corridor (B) 12:15

Duties of lieutenant: (1) Takes over captaincy if captain is absent — East: assists captain as requested; West: assists first-floor patrolmen during noon movies; (2) secures and checks belts from laundry on Monday at 10:00 a.m.; (3) isues all patrol belts at 12:45 patrol movies; (4) collects belts at 12:45 patrol movies; (5) gives out belts for assemblies; (6) issues belts at 3:00; (7) collects belts at 3:10; (8) keeps daily tabulation and count of belts at 12:45 and 3:20; (9) returns belts to shop each day at 3:10; (10) takes belts to laundry on Friday at 3:10. (Leaves copy of belt report with belts on Friday.)



Patrol positions

Duties of the patrolmen: Each patrolman is charged with the responsibility of enforcing the traffic rules and regulations entrusted to him as an officer. He has the authority to issue a patrol court summons to any student who does not conduct himself properly or who does not obey the patrol rules at his post. Some of these offenses are as follows:

1. Chasing another boy
2. Horseplay
3. Fighting
4. Smoking
5. Refusal to clean up at lunch tables
6. Refusal to obey orders
7. Defacing school property
8. Refusal to present a pass when required

The patrolman is likewise held responsible for the authority entrusted to him and his conduct as a patrolman. The character training and recognition of rules of conduct as apparent to the student and patrolman should carry over during the school semester, lending respect and dignity to the position of the patrolman.

The following instructions specifically outline the responsibility of each patrolman. The drawings show locations of all posts and the daily tabulation forms should eliminate any misunderstanding regarding specific duties and responsibilities.

General routine:

1. Wear belt to (patrol lunch) at 11:00
2. Report to post at 11:20
3. Remain on post during academic lunch period and movies 11:40 to 12:10
4. Remain on post during shop lunch period and movies 12:10 to 12:45
5. Report to patrol movies at 12:45
6. Report to post at 3:00 (wear belt)
7. Turn in belt to lieutenant at 3:10
8. Patrol court sessions at 10:00 (wear belt). (See daily bulletin.)

Post No. 0 Zero

All assemblies 11:20 to 12:45. 3:00 to 3:15.

Main Front Door Center Exit. This post under captain of East patrol.

Duties:

1. Do not allow students to enter gymnasium during movies.
2. Do not permit students holding *lunch passes* to leave building.
3. Direct students holding lunch passes to West exit.
4. Permit students holding *early dismissals* to leave building. Patrolman may examine time on early dismissal cards. Lift only pink dismissals (form HS 12).
5. Do not permit students from auditorium to use center office stairs. (Commercial art students only exceptions.)
6. Do not permit students to leave building during assembly. Maintain order at all times.

Post No. 1 East (2 boys)

All assemblies 11:20 to 12:45. 3:00 to 3:15.

Front Door (Gymnasium side). This post under captain of East patrol.

Duties:

1. Do not permit students holding lunch passes to leave building.
2. Permit students with early dismissals to leave building.
3. Do not permit students to leave building during assemblies.
4. Order all students to cafeteria during lunch periods. Do not permit loitering around doors.
5. Maintain order all the time while on duty.
6. During basketball games these doors must be locked. Patrolman may examine time on early dismissal cards.

Post No. 2 West (2 boys)

All assemblies 11:20 to 12:45. 3:00 to 3:15.

Front Door (Auditorium side). This post under captain of West patrol.

Duties:

1. Do not permit exit to students who say they have forgotten their lunch passes. It may so happen that they have been turned in to Mr. Coyte for returning late. A hole punched in the pass denotes delinquency and student's failure to return on time.
2. Take up lunch passes during lunch periods. Return all lunch

passes to mailbox No. 7 after 12:45. Return first period lunch passes at 12:40. Order all students not holding lunch passes to cafeteria during lunch periods.
3. Do not permit students to leave building during assemblies.
4. Permit students with early dismissals to leave building.
5. Maintain order at all times. Do not permit loitering around doors.
6. Permit students returning from lunch to go directly to movies.

Post No. 3 East

All assemblies 11:20 to 12:45. 3:00 to 3:15.
Double Doors (East End). This post under captain of East Patrol.
Duties:

1. The duties on that post are to keep the academic students out of shop corridor during the academic lunch period, and shop students to stay out of academic corridor.
2. To see that no one crosses through the office corridor.
3. To first hold and then to inspect permits. Let the shops go to lunch at 12:06.
4. Friday the shops are permitted to go to lockers in the academic building, and academic students to shop lockers.
5. To prohibit boys from remaining in the shop corridor during the lunch period (12:06 to 12:40).
6. Stop cross traffic through office corridor. Maintain order at all times.
7. During basketball season keep students in line in shop corridor until game time. Examine activity tickets if ordered to do so. Receive help from captain during basketball games.

Post No. 4 West

All assemblies 11:20 to 12:45. 3:00 to 3:15.
Double Doors at West End of the Office Corridor on Balcony Side
This post under captain of West patrol.
Duties:

1. To check activity tickets at balcony doors during special programs.
2. To keep order in the balcony.
3. To see that no students cross through the office corridor, unless they are going to the office (commercial art excepted).
4. Stop cross traffic through office corridor.
5. Allow the shops to go to lunch at 12:06, if shop instructors have entered elevator.
6. Friday the shops are permitted to go to their lockers in the academic building and the classrooms to shop lockers.
7. To prohibit shop boys from remaining in the shop corridor during lunch time (12:06 to 12:45).
8. All boys must go to the cafeteria and not loiter in the driveways. Maintain order at all times. Have auditorium lights turned out at 11:45.
9. Have auditorium doors closed at 12:00 and at 12:30. Examine all activities tickets when required. Receive help from captain during noon movies and assemblies.

Post No. 5 East

All assemblies 11:20 to 12:45. 3:00 to 3:15.
Automobile Entrance on Crawford St. (East End). This post under captain of East patrol.
Duties:

1. Two doors, the automobile entry and the corridor entry, must be watched.
2. Do not permit boys with lunch excuses to leave building.
3. Do not permit any boys to leave through this exit except at 3:15.
4. Do not permit boys to drive cars out of building during lunch hour.
5. Help clear corridor during lunch period (12:06 to 12:40).
6. Maintain order at all times.

Post No. 40 West

All assemblies 11:20 to 12:45. 3:00 to 3:15.
Main Floor Auditorium Doors. This post under captain of West patrol.
Duties:

1. During noon movies open doors at 11:45.
2. Have auditorium doors closed at 12:00 and 12:30.
3. Examine all activity tickets when required.
4. Accept all monies or part admissions.
5. Issue patrol summons to disorderly students.
6. Inspect seats and floor for refuse.
7. Clear balcony when program is over.
8. Maintain order at all times.
9. May order house lights turned on if audience is disorderly.
10. May call help from patrolman No. 36 at back door.
11. See that ventilator is turned on; if not on report to Mr. Kirby (should be turned on by 11:45).
12. Keep other patrolmen out of auditorium during movies.
13. Permit entire patrol squad to see picture at 12:45.
14. During assemblies permit patrolmen to see the second assembly 10 minutes after the students have entered.

Cooperative Education in a Technical Institute

LEO F. SMITH and DONALD K. BECKLEY*

Many articles have been written during the past ten years about cooperative work programs in colleges and high schools. Yet little has appeared during this period regarding cooperative programs in the technical institute — a type of institution particularly well suited to cooperative plans. This lack of emphasis on the technical institute is perhaps understandable in view of the fact that there are few such institutions as compared with the hundreds of colleges and thousands of high schools. Yet in the light of our present demands for trained workers and the planning currently being done for postwar education, serious attention to the work of the technical institute may well be in order. It is the purpose of this article to depict a cooperative work program in action in such an institute. Many of the techniques of administration and co-ordination to be presented here are readily applicable to both secondary and higher education.

The Rochester Athenaeum and Mechanics Institute in Rochester, N. Y., is a privately endowed, nonprofit-making educational institution which offers technical training on a cooperative basis. This program has been in operation continuously from 1912 to date with only a brief break during and immediately following World War I. It is the oldest technical-institute cooperative-work program in existence, and is exceeded in age by only two universities, Cincinnati and Northeastern, whose programs were initiated in 1906 and 1910, respectively. In the Rochester plan, occupational and general education are considered as interrelated, and provision is made for the continuous integration of work and school experience. The cooperative program is currently carried out at the college level, and three-year courses are offered in six areas: electrical, chemical, mechanical, photographic technology, retailing, and food administration.

Since this program is at the college level, the students accepted are high school graduates, and a number of them have had one or more years of college training. As a general rule, students 18 years of age or older are given preference, since under normal business conditions it often proves difficult to place younger people in cooperative jobs. The majority of the students live in the western part of the state of New York, but come also from many other states, and in peacetime from Canada as well.

*Rochester Athenaeum and Mechanics Institute, Rochester, N. Y.

Cooperative students at work

The cooperative program carried on at Rochester is that known as the alternating block plan. Under this system, students alternate four-week periods of classes and work from September until June. This plan serves to provide two students for each job, at least one of whom will be working at all times during the school year. Ordinarily at least one of the two alternating students in each pair is available for work during the school vacations at Christmas and in the summer. Thus students are available for employment during the entire year — a necessary condition if employers are to be made to feel that they can rely upon cooperative students in the same way that they can depend on their regular full-time employees.

While the regular alternating block plan outlined above takes care of the normal employment needs of the cooperating business organizations, additional flexibility is provided to help the employers during peak seasons. In the retailing department, for example, no classes are held during the period from Thanksgiving until after the Christmas vacation in order to meet the Christmas season employment demands of the stores. It is realized that employers naturally want workers when they need them, whether or not that time happens to correspond with the period originally planned for the student to work. Hence every reasonable effort is made by the Institute to have students available for work when they are needed, and where necessary, individual schedules are arranged. Only those kinds of employment which have a direct bearing on the occupational goals of the students are regarded as cooperative, and students are placed in jobs only where they receive the same wages as other beginning workers.

The administration of this cooperative program is in the hands of each department rather than through a central office of co-ordination. The department heads are responsible for counseling students in their respective departments, and for making the contacts with industries. The counseling of students is aided by the use of the *behavior journal*, which brings together the results of classification examinations, incidents of student behavior noted by faculty members, summaries of conferences held with students, and periodic reports on individual adjustments and personal needs, as revealed by the continuous picture obtained from the journal. Another source of valuable information on student progress is the work report, a detailed rating of student job performance made out periodically by the student's direct superior on his cooperative job. At regular intervals also, the students turn in a report on their job experiences.

Student placement and co-ordination work are handled by the department head or by another member of the faculty who serves as a teacher-co-ordinator. On the basis of the needs of the various cooperating industries, students or prospective students are sent for interviews. Although the actual hiring is done by the personnel men in industry, considerable weight is usually given by them to the suggestions of the co-ordinators. Since the institute can best serve its purpose by meeting the needs both of employer and student, special care is taken that the student sent for an interview is of the type best suited to work in that particular organization, and on the other hand that the job being applied for will be most beneficial in the student's total educational program.

The organizations hiring institute students are largely located in Rochester and the other industrial and commercial cities of western New York, including Syracuse, Buffalo, Niagara Falls, Elmira, and Binghamton. These organizations look upon students as promotional material, and normally arrange a sequence of jobs so that a student has the opportunity to make a special study of the processes in a plant or of the activities in a retail store. For example, one large optical firm in Rochester employing a number of cooperative students from the mechanical department has a carefully planned sequence of training jobs which make it possible for each student to obtain a wide variety of valuable experiences all in harmony with his major field of study. As a general policy, students are not moved from one cooperating institution to another during their course of training unless such a move would be agreeable to both employer and student.

While there is doubtless some benefit to be derived from working in several organizations, the more detailed experience to be obtained from doing a number of different jobs in one organization seems far preferable.

The contacts of the institute with the employing organizations are by no means completed when the student has secured his cooperative job. Regular trips are made by the co-ordinators to talk with company executives and to check on student progress. Weaknesses shown on the job often can be corrected by sympathetic counseling when the student returns to classes. Any general student deficiencies noted by the employers are carefully studied by the faculty, and the necessary changes in curriculum or in emphasis are made as a result to provide more thorough training in a certain area. The school, student, and employer are all able to profit from the exchange of suggestions made between the employers and the department co-ordinators by letter, telephone, personal visit, and through use of the work reports mentioned earlier.

Another means of providing closer relations between the institute and its cooperating employers is through periodic conferences. For example, several years ago the retailing department at the institute inaugurated a semiannual informal conference for personnel executives of the department stores in western New York. This conference consisted of open meetings during a morning and afternoon, and questions considered important by the executives who are invited to attend are discussed. All necessary correspondence and preparation of minutes of the meetings are handled by the institute, but the conduct of the meetings is entirely in the hands of the store representatives.

Keeping the subject matter taught in the courses sufficiently practical is a problem of the utmost importance in any cooperative program. While basic theories must be presented if students are to have a sound background of information, it can happen that the courses come to be entirely theory. Maintaining the courses on a practical basis is handled at the institute in several ways. The courses themselves are built upon a series of activity analyses of the jobs for which the students are being trained. These analyses are checked continually, and are revised whenever necessary. Course materials are altered in accordance with changing job needs, and thus are kept on a practical basis. Each student is trained not for unit trade skill, but for proficiency in a cluster of jobs within his chosen occupational field. Coordination of theory and practice is thus obtained as the student works on jobs within his chosen field and studies from manuals based on analyses of duties, skills, and attitudes of successful workers.

Another means of keeping course work practical is through the general policy of the institute which encourages the instructors to work in industry during their vacation periods. Thus instructors often spend their summers or their Christmas vacations in industries or in stores. This practice makes it possible for the faculty members to keep in close touch with conditions in the field, to observe student progress in actual job situations, and to earn additional money. Their working also serves a useful purpose in making the management and foremen better acquainted with the faculty members, and in providing additional experienced workers often at times when they are badly needed.

Student dietitians combine technical training with supervised experience on this job

A third method of providing the courses with practical emphasis is that of inviting, at frequent intervals, executives of cooperating organizations to speak to the students. Current conditions in the field and present job opportunities are usually stressed. Often these executives are alumni of the institute who have made substantial progress in the same companies in which they worked as cooperative students.

Much of the discontent which in some cases has resulted from cooperative work programs has been caused by unsatisfactory arrangements between employers and students regarding the matter of employment after graduation. In this regard, all three of the groups concerned — students, employers, and schools — have been in some measure to blame. In some cases, students have been unwilling to take any real interest in the participating firm by which they were employed; considering it to be a good place to train, but planning all along to go elsewhere immediately upon graduation. Employers have often been to blame by making no effort until it was too late to encourage the former students to remain with the company upon their graduation. The cooperative institutions also have by no means been completely free from responsibility in this regard. Often students have been placed in jobs solely because a vacancy existed — without serious concern as to whether or not the student and employer met each other's needs and had prospects of working out satisfactorily together.

At Rochester this problem has been attacked through making every effort to place students only on jobs which have definite training possibilities and by not placing large groups of students in any one company. Wherever possible, students are placed in organizations in or near their home cities, where they are most likely to want to work upon graduation, and where they will tend to have numerous interests in common with the other employees. In the case of those students coming from areas in which there are no stores or industries available for cooperative work in the fields in which they are interested, a decided effort is made to place them on jobs in cities where they would like to live. Thus the students feel more obligated to make good on the job than might otherwise be the case if they felt that they would be leaving upon graduation. At the same time, a reservoir of desirable employees is built up which would not otherwise exist.

Follow-up studies of graduates indicate the effectiveness of such a policy of aiding students to make permanent job contacts. For example, a study of 403 men who had graduated from the electrical department during 1925–39, inclusive, reveals that 77.3 per cent of those employed had remained in the field for which they were trained. It would appear from this that cooperative work provides an orientation to the vocational world which assists individuals while students to clarify their occupational goals and to establish contacts leading to permanent employment upon graduation. Another significant relationship is shown by the fact that of the 337 electrical-department graduates originally accepted as trainees by cooperative companies, 44.8 per cent remained with the firms with which they had been cooperatively employed, and 19.6 per cent were employed by other cooperative companies. Obviously a type of education which provides promotional material to industries and reduces the employee turnover of those inducted by this method to 35.6 per cent (100.0–64.4) over a 15-year period is looked upon with interest and satisfaction by industrial leaders of the community. Follow-up studies of graduates of other departments indicate approximately the same percentages of graduates remaining with the cooperating companies.

An institution offering a program of cooperative education must keep constantly in mind the fact that it has a definite obligation to itself and also to the student and the employer. To itself it has the responsibility of continually evaluating its program in the light of the objectives it seeks to fulfill. At the same time it must keep up the academic standards it has set, and must be alert to opportunities through which it can serve more fully the educational and vocational needs of its community. Its obligations to the student is primarily that of offering a well-rounded program of general and technical training, and of providing and carefully supervising job contacts which will enable the student both to secure a training job while in

school and also to make a satisfactory permanent connection upon his graduation. To the employers, the institution has the important obligation of providing a pool of potential supervisory material who as students and graduates will be able to bring to their jobs skills and understandings based upon the best practices in the various industries.

Seeking at all times to protect the interests of school, student, and employer calls for a high degree of flexibility both in curriculum and in administration. When an institution bases its program upon sound principles and methods, and keeps constantly in mind the purpose of its existence, it can be a most useful instrument of education. Its success or failure can be indicated clearly by the record of its graduates, and by the willingness of employers to cooperate in hiring its students.

Why Not Let The Boys Help?

LEONARD E. SCHMIDT*

Shop teachers, like housewives, occasionally decide to change the arrangement of their shops. Sometimes there is a good reason for the change; at other times it is just to break up the monotony of seeing the same things in the same place day after day and year after year.

When the writer came to this school the presses were installed and ready to run. Anyone feeding these presses faced the south windows which look out on a well-used road. This arrangement had two objections: (*a*) the boy's attention was often taken from his work by someone passing; and (*b*) the sun shone in on the presses most of the day.

Shades were installed, but since the windows were of factory type and opened out, this meant leaving the windows shut. Therefore, the shades were not the perfect solution. A rearrangement of the presses was then decided upon. Then the class was called together in the study section and asked what feature of the shop they thought should be changed. Almost every boy remarked that the presses were in the wrong place. Other suggestions were made that were good. Then the students measured all of the equipment and put the figures on the blackboard. A scale was adopted, and pieces of paper were cut to the size of the shop according to this scale.

Each boy was then given such a piece of paper, and set to work with pencil and ruler to plan the shop according to his own ideas. The results were surprisingly good. The three best were selected and the boys who made them got together and made a final plan incorporating the best features of each. The instructor acted only in an advisory capacity, and the students did all the actual work. This final plan was then submitted to the principal for his approval. After the plan was approved, the equipment was rearranged as the boys thought it should be, and the students, sensing probably for the first time that this was their print shop, took much more pride in keeping it in a workmanlike condition.

*Printing Instructor, Lincoln Hall, Lincolndale, N. Y.

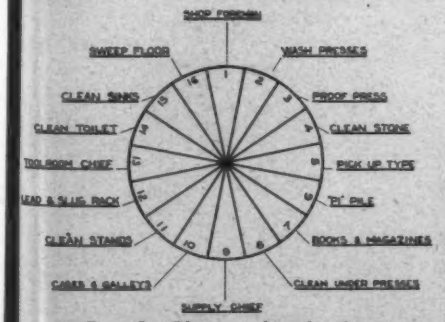


Fig. 2. The work wheel

The Work Wheel

With the changing of the shop, the writer decided to develop a work wheel that would show each boy exactly what job he had to do on a given day to keep the shop in good order. This work wheel is not a new idea, but strangely enough it is not used as much as it could be.

Since there are 16 boys in each class, a circle divided into 16 parts was drawn on the blackboard. The parts were then numbered from 1 to 16, with number one at top center, as shown in Figure 2. A line was drawn from each of the numbers as shown. Paper and pencil was then passed out to the students with the request that each one would list the jobs that had to be done in the order of their importance. From these various lists the arrangement shown in Figure 2 was worked out. The wheel was then made of wood, and it has answered very well at cleanup time because the students have realized the necessity of an orderly procedure. This is another fine example of letting the boys help.

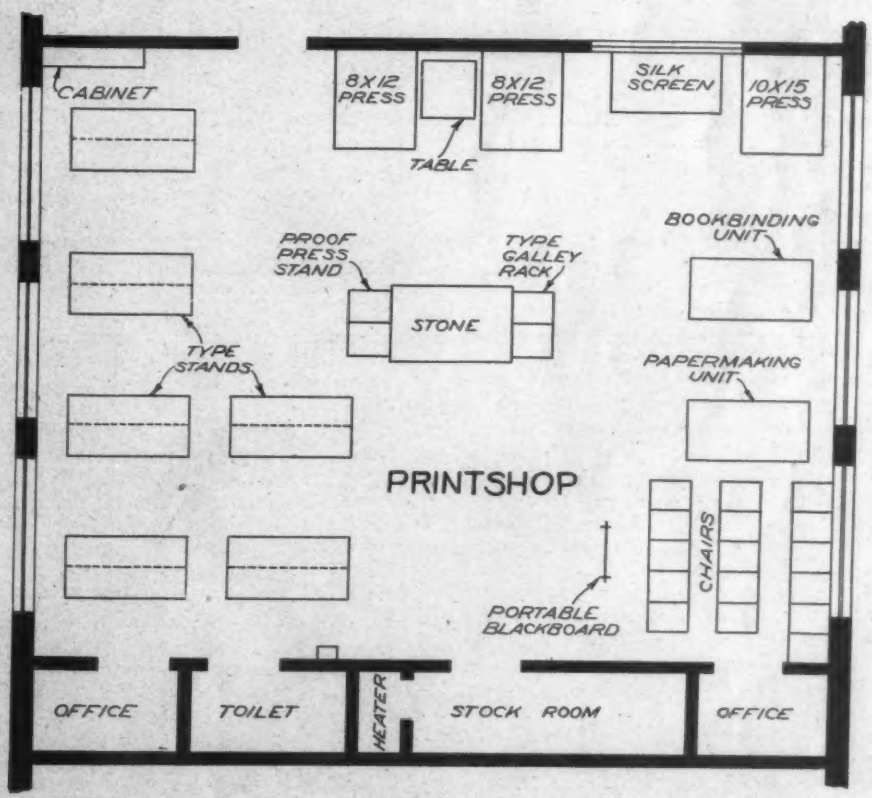


Fig. 1. The print shop with equipment rearranged

General-Shop Planning Center

RICHARD H. STOTTLER*

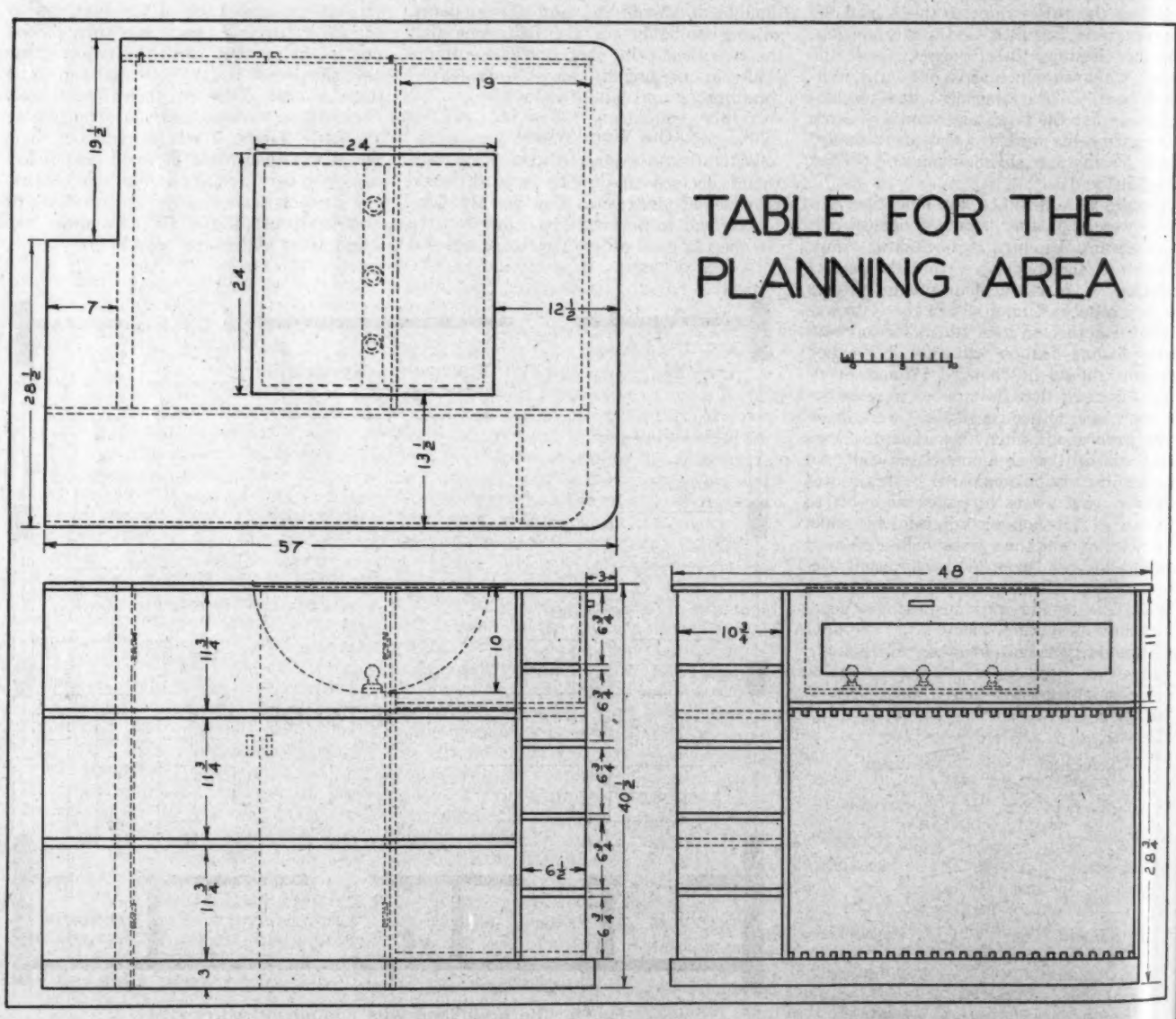
The planning center may be looked upon as the hub around which the general shop revolves. The various units of work planned at this center keep the wheel of activity spinning at a more constant speed than is the case of the shop without a well-organized planning unit.

The planning center described herewith has storage space for reference books, magazines, drawing equipment, and supplies; a built-in tracing unit; a series of shelves in the front corner used effectively to display small shop projects; and a general storage compartment at the back that is easily accessible.

*Director of Industrial Arts, Croton-on-Hudson, N. Y.

In order to include all these conveniences in one unit, several problems had to be solved. The first consideration was the location and amount of space that should and could be taken from the existing shop layout without overcrowding a floor space already congested. It was decided to locate the unit near the exit door, because the library is close at hand, and from time to time students find it necessary to obtain reference books, such as the *Reader's Guide*, encyclopedias, etc., that are not available in the shop library. This location placed the unit close to the teacher's desk and filing cabinets, where records, such as project cards, operation and progress charts, student folders, and blueprints are filed or displayed. Also, the entire unit is on the opposite side of the room from the dust of woodworking machines.

The amount of space was controlled by the homogeneous grouping of books, magazines, and drawing equipment. The overall dimensions of books and magazines in the shop determined the space needed to house them. The same consideration was given to the drawing equipment, and in each case allowances were made for expansion. The size of the tracing unit was controlled by the size of frosted plate glass that we could secure at a low price. Fortunately for us, as a result of inquiries we



were given our glass. Sources of such plate glass are old office doors, house doors, or show cases.

Building the various units into one was accomplished by constructing a form of white pine 2 by 4's on which the bookshelves and the unit to hold the drawing boards and instruments were erected. We used panels of 5-ply fir as the sides of the drawing equipment unit, for the doors to the storage compartment and for the top. The plate glass was frosted on one side, and recessed flush with the top. When finished the entire unit was painted steel gray, and trimmed with royal blue.

Some Functional Aspects of a Vocational-Industrial Education Program

LESTER V. HILL*

If one should, for one reason or the other, become obsessed with the desire to travel it is only natural to assume that such a person would first select a definite destination. Assuming, then, that a destination has been selected, we would next expect the would-be traveler to acquire or take cognizance of his needs. Means and methods of involving needs and allied factors are all complementary parts of the overall — a journey to a selected destination. Though the trip be by land, sea, or air, the basic considerations would seem to remain the same. Maps, charts, compasses, time tables, logs, etc., may serve as guides or checks. For, armed with these, the would-be traveler might determine (1) whether he is headed in the direction toward his destination, and (2) at intervals check or measure his progress.

There may or there may not be similarities. But advanced thought in education would set up a destination (ultimate goals or objectives) and let needs dictate ways and means of realizing the goal. Those of us who are interested in realizing the ultimate objectives must likewise be interested in the progressive effectiveness of our educational services. Consequently, it is suggested that at spaced intervals, and by various methods, teachers and administrators of vocational-industrial education should check the effectiveness of their training programs. In this connection four questions arise: (*a*) If the ultimate goal be efficient workers and intelligent citizens, to what extent is the training program adequate? (*b*) What changes are needed to meet the needs of the students and community effectively? (*c*) To what extent is the training program practical? (*d*) Does the training program really function in the lives of the students and the community? Any answers to these questions would certainly aid in determining whether the training program points in the right or wrong direction and whether we are on the right track.

Follow-up studies are often suggested as one method of checking the functional aspects of the training services offered. Also, school co-ordinators and public relations officers are often in a strategic position to measure the effectiveness of school training programs. However, it should be pointed out that most follow-up studies have been largely concerned with graduates. While on the other hand, few or if any such studies deal with students while they are continuing their high school courses. Any such studies, of course, would necessarily have to be concerned with summer and afterschool hours employment. It may be observed that any study which reveals a large scale percentage of students doing summer work or after school hours work in occupations for which they are receiving training, or allied occupations, should be interpreted as an effective vocational-industrial training program. Furthermore, such a revelation might also be interpreted as indication of interest, first-rate instruction, good selection, a functioning guidance and placement service, good school-community relations and many other deep rooted ramifications. It is with these considerations in mind that a check up was undertaken of the functional effectiveness of the vocational-industrial training program as offered at the Maggie L. Walker High School, Richmond, Va. This study (of 231 Walker students gainfully employed during the summer months of 1942) and its implications will be considered in the following discussions.

The Maggie L. Walker High School

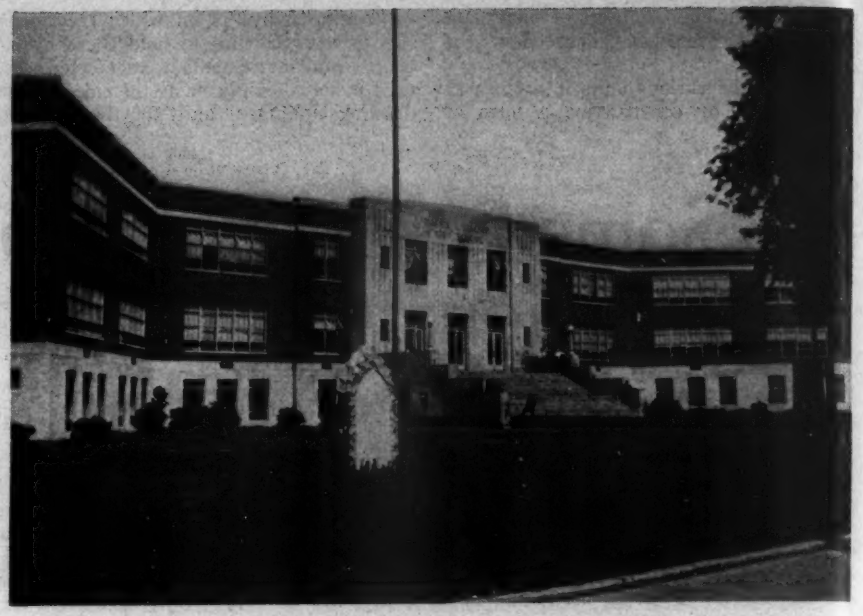
On September 9, 1938, the Maggie L. Walker High School formally opened its doors and began its all important task. It is significant that the school should be named for the late Mrs. Maggie L. Walker, for Mrs. Walker seemingly "Lifted herself by her own boot straps." She rose from the obscurity of a lowly washwoman to become the first woman bank president in the history of our country. Her whole life was dedicated to the advancement of her race. The very name of the school should be an inspiration to all youth who study within its walls. And God grant

*Department of Industrial Arts and Industrial Education, Richmond Public Schools, Richmond, Va.

Vocational class in sewing and vocational class in beauty culture at the Walker High School, Richmond, Va.

that they may see fit to follow the "footprints in the sands of time" that will undoubtedly lead to a life of hope and service. For history will record the name of Maggie L. Walker with those of Booker T. Washington, George W. Carver, James Weldon Johnson and many others.

"The plan of organization at Maggie L. Walker provides for practical-arts instruction with both industrial arts and vocational emphasis. The school is well equipped for training in building maintenance, masonry and plastering, shoe repairing, busheling, beauty culture, barbering, domestic service, hotel service, cafeteria service, homemaking, commercial arts and diversified occupational training. . . . The first two years at this school the pupil will be encouraged to rotate through and explore occupational fields on a five hour weekly schedule, after which he will be permitted to devote a maximum of fifteen hours a week to the occupation of his choice. . . . The objective of the practical-arts program . . . is to offer a sound general high school education and at the same time practical training for some occupations of his own choice and which offers employment opportunities immediately upon completion of high school."[1]



Maggie L. Walker High School, Richmond, Va.

PROGRAM OF STUDIES

1st year	*2nd year*
English 1 and 2	English 3 and 4
Physical fitness	Physical fitness
General mathematics 1 and 2	Choice of:
General science 1 and 2	Vocational laboratory, 3 hours, or
Industrial arts	3 Electives
3rd year	*4th year*
English 5 and 6	English 7 and 8
Physical fitness	Physical fitness
Choice of:	Choice of:
Vocational laboratory, 3 hours, or	Vocational laboratory, 3 hours, or
3 Electives	3 Electives

NOTE: Every pupil must take physical fitness each semester. If required subjects prevent scheduling of physical fitness at one of the regular periods, the pupil must take it during the Victory-Corps activities period. This will apply to pupils who must take diversified occupations theory and some pupils who must take English 5a.

Victory Corps

The Victory Corps is a nationwide wartime student organization. It is democratic and voluntary in character. Pupils are invited to enroll in this organization which will give recognition to war preparation and service. A "Victory Corps" period (40 min.) is provided 2 days per week during which pupils may engage in the activities as listed in the following table.

In addition to these subjects, there are many subjects offered as electives in the regular program which Victory Corps members should choose properly to aid in preparation for war service. Membership in the Victory Corps is symbolic of the pupil's desire and determination to do his or her bit to help win the war and peace.

Air Service Division	*Land Service Division*	*Sea Service Division*
Chemistry	Chemistry	First Aid
First Aid	First Aid	Trigonometry
Aeronautics	Trigonometry	Personal Hygiene
Trigonometry	Personal Hygiene	Algebra
Personal Hygiene	Algebra	Physics
Algebra	Journalism	Junior Red Cross
Physics	Cadet Corps	Navy Club
Junior Red Cross	Physics	
	Junior Red Cross	
	Camouflaging	

Production Service Division	*Community Service Division*
Chemistry	Chemistry
First Aid	Vocal Music
Salvage Service	First Aid
Personal Hygiene	Girls' Conference Club
Algebra	Crocheting
Physics	Salvage Service
Junior Red Cross	Nursery Service
Mechanical Drawing & Blueprint Reading	Personal Hygiene
	Algebra
Electricity	Dramatics
	Journalism
	Typewriting
	Cadet Corps
	Physics
	Junior Red Cross
	Victory Garden
	Girl Scouts
	Hi-Y

Summary of the Program of Studies

1. The 3 major courses are Vocational Trade, General Occupations, and Diversified Occupations.
2. Pupils may begin specializing in the vocational training course in the second year (9L). However, those who are undecided may select electives in the second year and begin specializing in the third year.
3. Pupils who plan to enter employment that does not require specialized school training (elevator operator, chauffeuring, postal service, etc.) should select the general occupations course beginning in the second year, and enroll in electives of their choice.
4. Pupils may not select the diversified occupations course until the third year. Those who plan to take this course should enroll in electives of their choice in the second year.
5. Electives offered: Music, art, industrial arts, dramatics, public speaking, home nursing, salesmanship, dining-room service, reading for enjoyment, family relationships (for juniors and seniors only), trade mathematics, senior mathematics.
6. Major subjects for specialization, beginning in the second or third year: (Girls and boys cafeteria and management, commercial food service (chef cooking), dining-room service.
7. All pupils take 2 different industrial-arts courses during the first year; art may be chosen as one of the two courses. Additional industrial-arts courses may be elected after the first year.

The Walker Study

During October, 1942, an inquiry made by home-room teachers of the Maggie L. Walker High School revealed that 305 Walker

[1]Annual Report of the Superintendent, Richmond Public Schools, 1938–39.

Vocational class in commercial food service at the Walker High School, Richmond, Va.

students were employed during the summer months of 1942. A questionnaire was distributed to these students to be filled out. The enrollment of the school as of June, 1942, was 995 and as 305 students were employed, this seems to indicate that roughly 30 per cent of the student body was gainfully employed for that summer period. The distribution of the 1942 summer employment may be observed from Table I. However, it should be pointed out that rigid enforcement of child labor laws may have reacted to lower the over-all percentage of this employment. Because of the setup of the Richmond Public Schools system, Negro pupils enter high school after completing the seventh grade. This means that the average age for the first year high school for 1942–43 was 14.3 years, and for the second, third, and fourth years 15.8, 16.7, and 16.9 respectively. And, as most employers are reluctant to hire workers under 16 years old, there are reasons for believing that many students would have worked, but because of their age could not find employment.

Students pursuing the general-occupations course do not train for any specific occupation, but are working either toward college entrance or will enter employment. While on the other hand, students specializing in the other major courses are working toward a trade certificate at the completion of high school.

TABLE I. Number of Walker High School students gainfully employed during the summer of 1942 according to majors.

Majors	*Number Employed*	*Number Enrolled June, 1942*	*Per Cent Employed*
Shoe repair	6	31	19
Commercial foods	13	25	52
Cafeteria service	6	18	33
Masonry	14	18	76
Beauty culture	18	36	50
Diversified occupations	19	27	75
General occupations	108	754	14
Clothing	17	40	48
Homemaking	15	22	68
Barbering	25[2]	4	..
Building maintenance	10	16	62
Art	4	4	100

These students spend three school hours per day in all-day trade classes of their selection. It will also be noted from Table I that 75 per cent of the diversified occupations students were gainfully employed. The distribution of this employment among the diversified occupations students was as follows:

[2]It should be pointed out that the barber shop was opened in September, 1942. Prior to this time there were only four students majoring in this course, and these were trained in the beauty shop.

Cleaning and pressing	5
Printing	2
Hotel service	3
Barbering	2
Life insurance	2
Auto-service	1
Maids	3
Tailoring	1

It may be observed, from Table II, that only 30 per cent of those students employed during the summer months were working in occupations for which they had received specific vocational training during the current school term. Also, it indicates that less than 1 per cent of these students were employed in jobs allied to the occupations for which they were receiving training. A full listing of the different occupations as reported by the students are given in Table III. This Table lists a total of 43 different occupations in which students found summer employment.

During the summer of 1942 employment opportunities in Richmond were rather plentiful as compared with conditions of a corresponding period of 1941. It is believed that this was due in part to increased demands made on industry and business by

TABLE II. Distribution of 231 Walker High School students employed in occupations and allied occupations for which they were being trained during the summer of 1942 according to majors.

Majors	*No. Enrolled*	*No. Working in Occup. For Which Being Trained*	*No. Working in Allied Jobs*
Shoe repair	31	4	1
Beauty culture	36	17	0
Commercial food service	25	6	1
Art	4	1	1
Clothing	40	2	8
Homemaking	22	11	4
Barbering	4	4	0
Building maintenance	16	1	0
Cafeteria	18	1	3
Masonry	18	1	1
D. O.	27	17	1
Totals	241	65 or 27 per cent	20 or .08 per cent

TABLE III. Occupations at which 231 Walker High School students were gainfully employed during the summer of 1942 according to majors.

Shoe Repair	*No.*	*Beauty Culture*	*No.*	*Com. Foods*	*No.*	*Art*	*No.*
Delivery	2	Housework	1	Newsboy	1	Delivery	1
Shoe repair	4	Cooking	1	Waitress	1	Bootblack	1
Grocery clerk	1	Beauticians	21	Soda clerk	1	Freight checker	1
Stock clerk	1			Nursemaid	1		
Veg. peddler	2			Drugstore	1		
Bootblack	1			Cleaning	2		
				Cooking	1		
				Presser	1		

TABLE III (Con't.)

Cafeteria	*No.*	*Masonry*	*No.*	*D. O.*	*No.*	*General Occupations*	*No.*
Newsboy	1	NYA worker	2	Laborer	1	Domestic service	23
Engine operator	1	Laborer	1	Presser	4	Delivery	19
Bus boy	1	Bus boy	1	Homemaking	1	Store clerk	5
Maid	1	Delivery	1	Tailor	1	Newsboy	55
Delivery	1	Waiter	1	Auto-service	1	Skating arena	1
Waiter	1	Houseman	1	Grocery clerk	1	Hat cleaner	1
Cook	1	Pin boy	1	Porters	2	Laborer	1
Laborer	1	Bricklayer	1	Waiter	1	Housework	11
		Tobacco worker	1	Janitor	1	Laundry work	1
				Shipping clerk	1	Sales girl	1
				Printing	5	Bootblack	1
						Baker	1
						Beautician	2
						Waitress	1
						Gardener	1
						Soda jerker	1
						Grocery clerk	1
						Bellhop	1
						Pin boy	11

TABLE III (Con't.)

Clothing	*No.*	*Home-making*	*No.*	*Barbering*	*No.*	*Building Maint.*	*No.*
Maid	5	Homemaking	11	Delivery	6	Painter	1
Bus girl	1	Nursemaid	6	Barbering	4	Delivery	1
Homemaking	8	Waitress	3	Gardener	2	Porter	2
Nursemaid	3	Hair dresser	1	Clerk	1	Dishwasher	1
		Cashier	1	Bootblack	1	Chauffer	1
		Sales girl	1	Janitor	1		
				Bus boy	1		
				Tobacco factory	2		

TABLE IV. How jobs were obtained by 231 Walker High School students during the summer of 1942 according to majors.

	Number Employed	*Through Guidance Office*	*By Relatives and Friends*	*Ads*	*Employment Agencies*	*In Person*
General occupation	35	2	21	1	2	9
D. O.	19	2	3	1	0	13
Art	4	2	2	0	0	0
Cafeteria	6	2	1	0	0	3
Shoe repair	6	1	4	0	0	1
Comm. food serv.	11	3	5	1	0	2
Clothing	17	0	12	0	0	5
Homemaking	15	5	7	1	0	2
Barbering	24	0	14	0	0	10
Masonry	14	2	3	2	0	7
Building maint.	10	1	7	2	0	0
Beauty culture	18	3	8	1	0	6
Totals	179	23	87	9	2	58

TABLE V. Appraisals of subjects by 231 Walker High School students gainfully employed during the summer of 1942 according to majors.

Majors		*Subjects of Greatest Value*	
General occupations	108	Mathematics	21
		English	19
		Homemaking	9
		Science	5
		Beauty culture	3
		Nursing	3
		Physical education	3
		Shoe repair	2
		None	48
Shoe repair	6	Mathematics	6
		English	3
		None	1
Commercial food service	13	Quantity cooking	8
		English	4
		Mathematics	3
		None	3
Cafeteria	6	Cooking	3
		Mathematics	2
		English	2
		Nursing	2
		None	1
Masonry	14	Mathematics	9
		English	8
		Masonry	3
		None	6
Beauty Culture	18	Beauty culture	18
		None	1
D. O.	19	Mathematics	6
		English	6
		D. O. theory	3
		None	5
Art	4	Mathematics	3
		English	3
Barbering	25	Mathematics	11
		English	10
		Barbering	4
Homemaking	15	Homemaking	14
		English	8
		None	5
Clothing	17	Homemaking	5
Building maintenance	10	English	5
		Building maintenance	22

TABLE VI. Appraisals of training by 231 Walker High School students gainfully employed during the summer of 1942 according to majors.

Majors	*Number Employed*	*Training Was Great Asset*	*Per Cent*	*Training Was of Little Value*	*Per Cent*
Shoe repair	6	3	50	1	16
Com. food service	13	12	92	1	.07
Cafeteria service	6	6	100	0	0
Masonry	14	14	100	0	0
Beauty culture	18	17	94	1	.05
D. O.	19	16	84	3	16
Gen. occupations	108	80	74	28	26
Clothing	17	12	71	5	29
Homemaking	15	15	100	0	0
Barbering	4	4	100	0	0
Building maintenance	10	8	80	2	20
Art	4	3	75	1	25
Totals	231	190	82	41	18

TABLE VII. Changes as suggested by 231 Walker High School students gainfully employed during the summer of 1942 according to majors.

Majors	*Number Employed*	*Suggested No Changes*	*Would Add These Courses*	*Number*	*Would Abolish*
General occupations	108	6	Typing	6	
			Foreign language	3	
			Chemistry	8	
			Auto mech.	6	
			Business	4	
			Physics	6	
Clothing	17	4	Typing	10	
			Spelling	3	
			Business	9	
			Foreign language	1	
Homemaking	15		Chemistry	1	
			Business	1	
			Foreign language	1	
Barbering	25		Typing	3	
			Auto mech.	2	
			Business	2	
Building maintenance	10	6	None	8	Disorder in School Bldg.
Art	4	2	None	2	
Shoe repair	6	0	Typing	2	
			Auto. mech.	2	
Cafeteria service	6	0	Foreign language	3	So many
			Business	2	Assemblies
Masonry	14	0	Typing	33	
			Radio repair	3	
			Mathematics	5	
D. O.	19	0	Typing	5	
			Bookkeeping	5	
Com. food service	13	0	Tailoring	3	
			Business	22	
Beauty culture	18				

the urgency of our National war efforts. In spite of the many opportunities for employment as evidenced in want advertisements, most students seem to have obtained employment through relatives and friends as indicated in Table IV. Also, it will be observed from Table IV, that most of the Diversified Occupations students applied in person when seeking summer employment. This fact may be interpreted to mean that these students approached the heads of their training agencies and asked for summer employment. The Guidance Office of the school placed a total of 23 students. This represents a larger number of placements than the combined number of students who found employment through want ads and employment agencies.

Efforts were made to get these students to appraise the training they had been receiving at Walker school in light of their summer work experiences. These appraisals are condensed and listed in Table V and Table VI. In light of these summer work experiences, 82 per cent of the students reported that the school training was a great asset to them on their summer jobs; while 18 per

cent reported that the school training was of little value to them on their summer jobs. Observing from Table V, the students seem to concur in their appraisals, that mathematics, English and in many instances their trade courses were the subjects that had been of greatest value to them on their summer jobs. When questioned as to what changes they would suggest only 18 students reported they would suggest no changes. While on the other hand 203 students suggested the adding of certain courses as listed in Table VII. A large number of the students suggested that the school should add such courses as typing, foreign languages, and business. In addition to these, some students suggested that some of the disorder in the school corridors should be abolished, also several students complained that too much time is lost from studies by having to attend so many assemblies in the auditorium.

Conclusions

It would seem highly improbable that the findings as presented in this discussion will afford adequate answers to the basic questions as outlined at the beginning of this article. However, it may be safe to say it seems at least that the training program at Walker High School is pointing toward the right direction. Also, from these findings it would seem to indicate that:

1. Either employment opportunities are more favorable for students having some specific skills, or such students are more aggressive or have more initiative than the students pursuing the general occupations (College preparatory) course.

2. The number of students who used their specialized training while working at summer jobs was greater than the number not making use of their training.

3. The majority of the students found that their specialized training was of a great asset to them.

4. There seems to be a sense of pride on the part of the students in their school and their training program.

5. The summer (1942) employment of the Walker students represented 43 different occupations. The classification of these occupations are as follows:

Domestic and personal service ...	26 or 60 per cent
Unskilled labor	1 or .02 per cent
Semiskilled labor	3 or .07 per cent
Skilled labor	4 or .09 per cent
Clerical and distributive	9 or 21 per cent

6. The classification and distribution of the offerings of Walker High School are as follows:

Major courses for domestic and personal services ...	6
Major courses for skilled occupations	4
Major courses for diversified occupations	1
Unclassified	1

7. It seems that these findings would indicate that the training program offered by the Walker High School is to be in a large extent effectively functioning in the life of its students and the life of the community.

It should be pointed out that no effort was made to ascertain whether those students employed on summer jobs found employment in the particular type of work as a result of the training course pursued in school, or whether choice of employment was circumscribed by sectional traditions. This may be a lead to further study.

The Development of a Program for Industrial Arts

D. ARTHUR BRICKER*

A. Delimiting the Field to Six Areas

Industrial-Arts Program. The industrial-arts program outlined in this chapter represents a departure from the usual plan of blocking out definite amounts and levels of work for the different grades of the secondary school. It is believed that the presented procedure will avoid controversies which arise because of the lack of agreement concerning the importance of the various units and the quantity of any unit that should be taught at any particular level of the shop program.

To take the new trends in education into consideration it is necessary to outline a flexible industrial-arts schedule which all teachers, directors, administrators, and pupils may understand and work with effectively. The program in this study of industrial arts will have six main areas, all of which will be broad in scope, covering the industrial-arts field which can be presented in the secondary school. See Chart 1. The six areas are as follows:

I — Graphic Techniques
II — General Woods
III — General Metals
IV — General Powers
V — General Crafts
VI — General Ceramics

Under each of the six areas, four divisions will divide the work into a more definite listing of subject matter. Each division corresponds to the names given for various courses listed in many of the current industrial-arts programs. Under each division will be found a list of teaching units to be explored by the pupil. It is from these units that the teacher will plan the instruction sheets, develop his lesson discussion, and guide the pupil into the many different occupational opportunities which the industrial-arts program has to offer. One of the many values of this program is the coding of all information, both the operative and the related, so that it will be ready for immediate use by the pupil. The organized plan for the industrial-arts program will help in the guidance program, since it will show the trend of interest and abilities as the pupil progresses through the different areas.

A very helpful way of dividing the areas is by using a color scheme along with the six areas, such as:

Buff for I — Graphic Techniques
Green for II — General Woods
Cherry for III — General Metals
Canary for IV — General Powers
Blue for V — General Crafts
Golden Rod for VI — General Ceramics

Colored mimeographed paper is used for the different areas, divisions, and units. This method makes it very simple for the pupil to keep his loose-leaf notebook and properly to file his information so that it is accessible for immediate use, and quick reference.

A program with 6 areas and 24 divisions lends itself to some present school organizations, which divide the school year into 6 grading periods. Thus, 6 semesters in the junior high school (7th, 8th, 9th); 6 semesters in the senior high school (10th, 11th, 12th); and 6 years in the secondary school are provided. All the combinations are easily worked out into a program with 6 and 24 as the numbers, to help divide the different school programs into workable units for instruction.

B. Content of Given Areas

I — Graphic Techniques (see Chart 2): The first area in the outline and all of

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the work related to graphic representation are placed under four divisions.

I — A. General Drawing: General Drawing consists of the beginning courses in mechanical drawing, the teaching of the fundamentals known as the language of industry. Under General Drawing come 12 teaching units (see Chart 2). After the student has completed these units, he may select work from the other divisions in the table, such as *I — B. Duplication* of all types, or he may choose one or more of the *I — C. Special Drawing* units.

I — B. Duplication: A knowledge of many kinds of machines, papers, and inks is called for by Duplication. All of the different methods of reproduction have distinct advantages regulated by the type, quality, and number of copies needed. The whole field of merchandising requires novel schemes of advertising and information concerning the costs and time required to furnish the copies. This information is valuable for the business executive, as well as for the worker who will be employed to produce the finished product.

I — C. Special Drawing: Under the third division, Special Drawing, are found 24 distinct types of drawing, each having enough demand to call for special study. Courses can be developed to almost any length of time, depending upon the amount of skill the instructor thinks the student should or can develop in the secondary school program.

I — D. Printing: Printing, with its series of units, correlates very closely with the other units under the first area, I — Graphic Techniques. Throughout the drawing courses offered under the first area, many ways of relating other secondary school subjects, such as mathematics, history, general science, biology, zoology, and others are found. Printing works hand in hand with such departments as English, dramatics, school publications, and printing of all forms for the various departments of the school.

II — General Wood (see Chart 3): The second area, II — General Wood, has in the past attracted more attention than any of the other areas to follow. In the past few years, the many new materials coming to the front in the very complex system of manufacturing and distribution make it necessary to divide the time, and to give the pupil a greater range of materials to explore and to use in the making of various projects. It has been agreed that practically all of industrial-arts work is general education and not vocational training.

II — A. Bench Woodwork: Bench Woodwork, with its series of different units covering the use of handworking tools, different kinds of woods, their place of habitation, the making and use of the many common joints, the types and use of glues, fastenings, method of layout, some of the many jigs to do special cutting and drilling, abrasives, and figuring the cost of the bill of materials, bears a close relationship to the practices employed in mathematics and science departments of our schools.

II — B. Machine Woodwork: Machine Woodwork gives instruction and practice on the 24 kinds of woodworking machines. These are the types of machines found when working on a job; but should a pupil never become an operator of such machines, the knowledge of the many operations and uses may be of great value to him in later years. In the school with very little equipment, many of the machines can be studied through visits to local manufacturing centers, or by motion pictures and slides. In the past few years, there have been many fine small machines on the market, which partially accounts for the home workshop becoming more popular each year. It affords an ideal opportunity for the use of leisure time, and in some instances supplies extra money for making useful articles and home repairs. The actual use of the laws of physics is applied through the use and operations of the different machines.

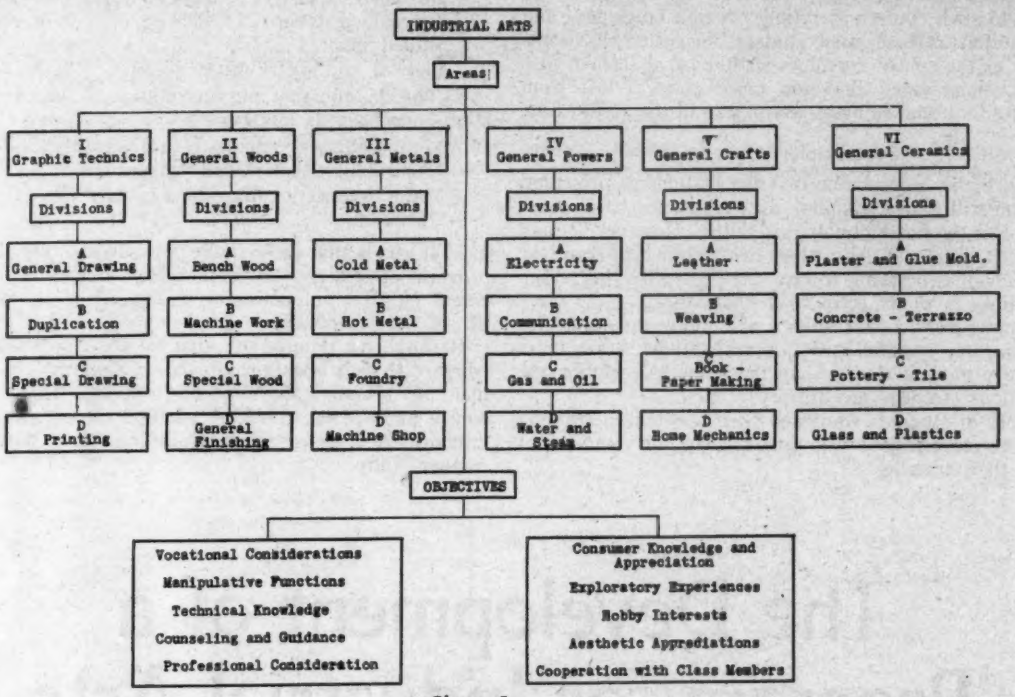

Chart 1

II — C. Special Woodwork: Special Woodwork is best fitted for the upper level of the secondary school, or for the pupils in advanced work beyond the regular junior high school program. The units under II — C will give technical terms, their meanings, and supply related information on different types of occupations; and will give general information regarding tools, materials, and supplies. Under the unit of II — C, a certain degree of skill will be demanded in work such as carving, veneering, and inlay work, patternmaking, woodturning, cabinetmaking, lathe turning, carpentry, and other occupational endeavors. If, after working with some of these courses, a pupil decides upon one of them for his lifework, a change of school should be recommended, where more specific training for the chosen profession or occupation could be obtained.

In these more advanced courses of the wood area, there is a definite need for mechanical drawing in the reading of blueprints and other drawings appearing in books and magazines. Also, the experi-

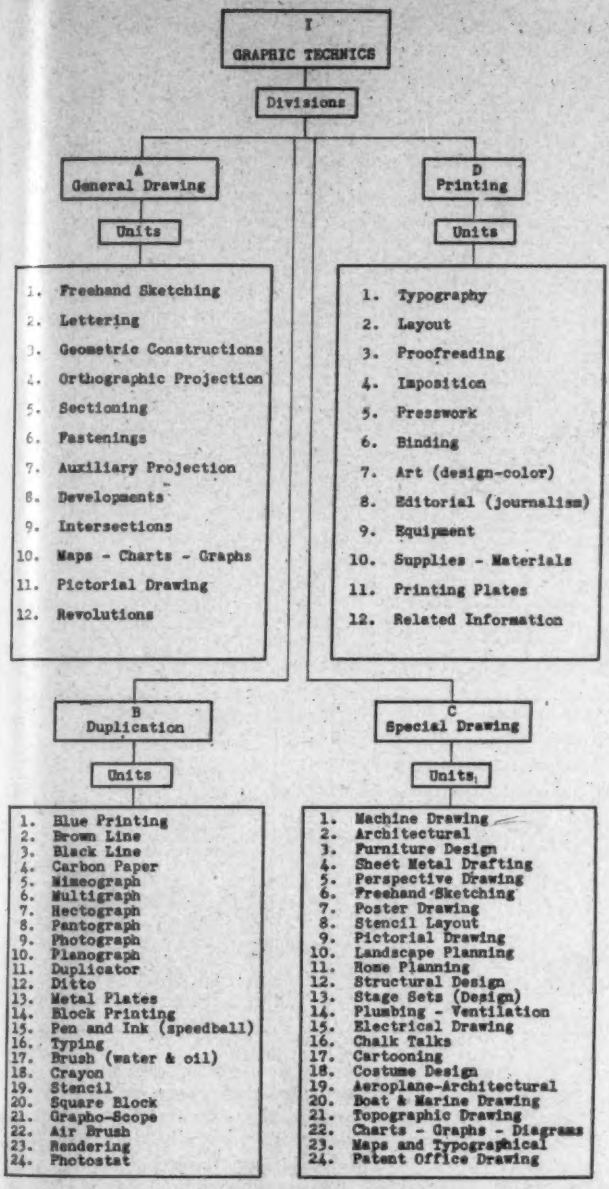

Chart 2

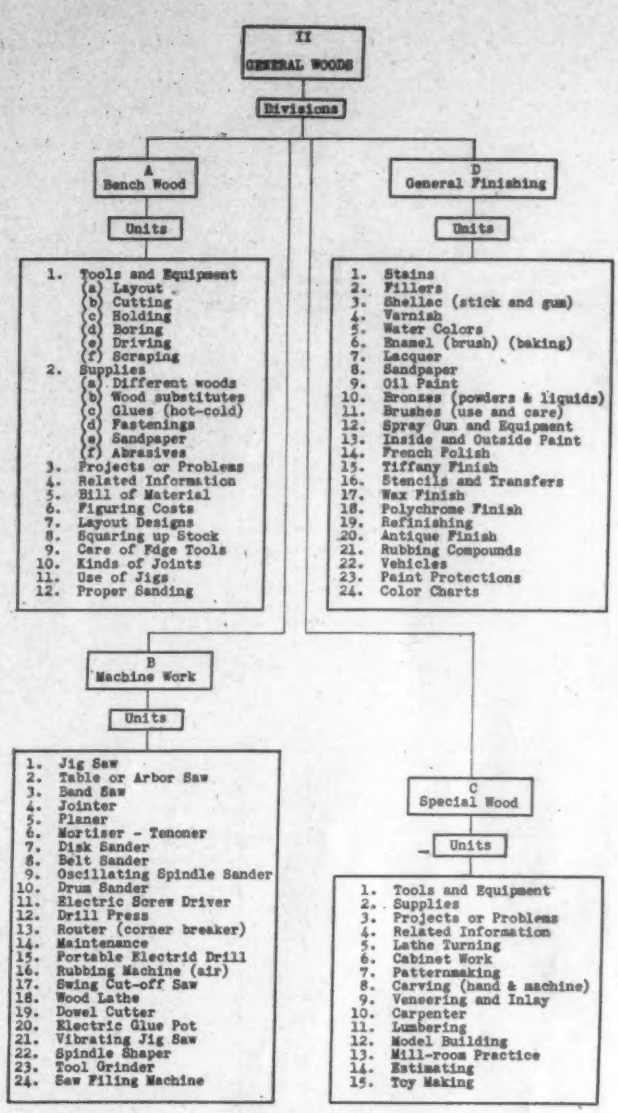

Chart 3

ence in the use of the many hand tools and supplies provided for in the II — A training is most helpful. All the way through, one area draws from the experiences acquired in the divisions of other areas. Special Woodwork calls for much outside preparation catalogued under related or industrial information, sometimes referred to as industrial intelligence. The different units under the II — C division give greater opportunities for caring for the individual, and for helping him to find his most useful place in our modern day method of living.

II — D. General Finishing: General Finishing is a very practical division which should have some part in every pupil's training. This knowledge is of use to both boys and girls. Every home is in continual need of some kind of repair or improvement, and such information as this unit offers under II — D is in constant demand. The selection and uses of the various kinds of paint and finishing material, proper care of brushes, and the protection of paint surfaces inside and outside of the home are a few items that would come under this unit. The refinishing and the repair of old furniture becomes a hobby with many people. To obtain the best results requires the proper selection and application of finishing materials. The mixing of colors and the different methods of application, such as brushing, how to hold and stroke with the brush, kinds of brushes, proper selection, the air brush (its care and operation), the dipping process, with the special kinds of material, all require careful study.

The related information affords much outside study. The color harmonies, manufacturing of paints, lacquers, stains, varnishes, enamels, and the many other materials and supplies in the unit under II — D are only a few of the units requiring attention. Manufacturing firms will supply many interesting booklets, movies, and slides which provide an abundant supply of material for study and general information.

III — General Metal (see Chart 4): For several thousand years, metal has played a very important part in the life of man. Not until the past decade has there been the development of new materials and alloys. Many of the new devices that modern living enjoys would be an impossibility without the recent discoveries. The people living in this and in future generations must have an appreciative understanding of the many new discoveries, their values and best uses.

III — A. Cold Metal: Under the division III — A, the unit of sheet metal becomes a very important study, which enumerates as many as 18 different forms of sheet metal and alloys in use today, that range all the way from 3 cents per pound to $48 per pound. The number of differ-

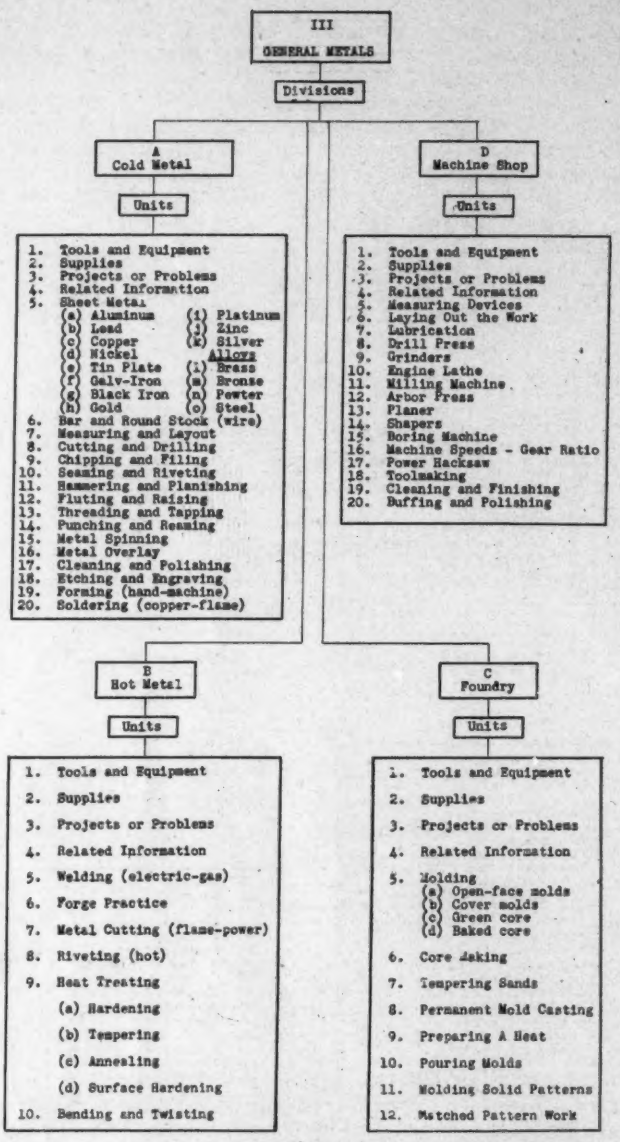

Chart 4

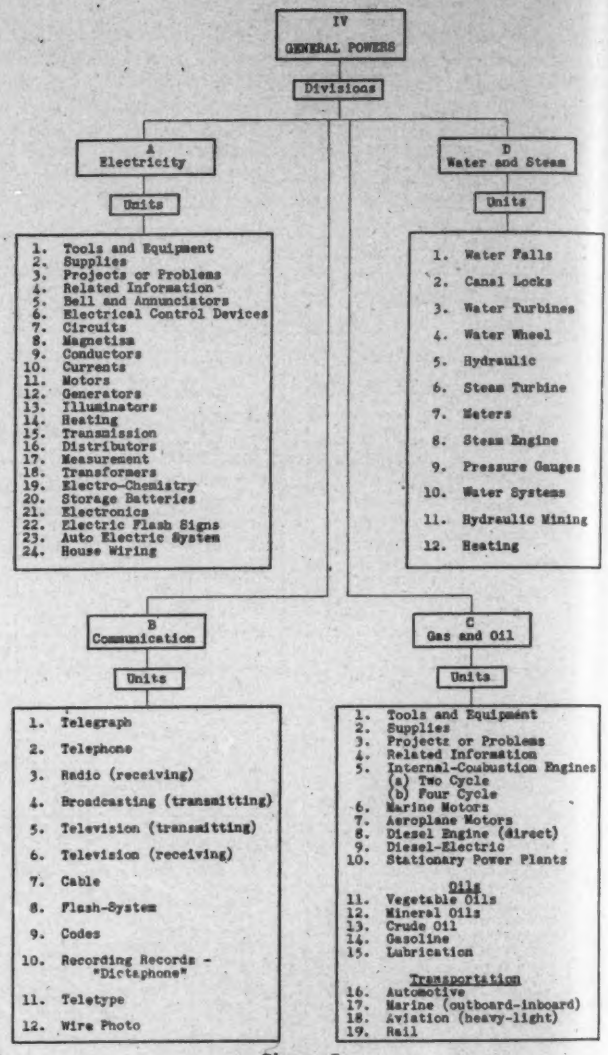

Chart 5

ent ways of applying finishes referred to in I — D have helped to provide many new uses for metal. The building program has made great demands for all kinds of structural steel and metal finishings. Metal window frames have practically replaced the wooden construction of a few years ago. The framework of small dwellings is fast being replaced with new metal construction supports which makes them stronger and renders them more nearly fireproof. Virtually all furniture at one time was made of wood, but now a variety of fine metal structure reproductions is used.

III — B. Hot Metal: Under the III — B division come all the operations and related information dealing with metal treated by some process of heating. The study of treating metals becomes a very lengthy one and requires much work and knowledge to develop skill. The shopwork affords many experiences in this division, such as working with different types of solder and fluxes, the annealing of different kinds of metal, heating and bending, welding and cutting, and tempering in oil, water, and air. Trips to the steel mills and other metal industries afford many experiences that will assist the pupil to a more complete understanding of the work in the industrial field. If there are no places of interest to go for trips, the motion picture will assist with many fine films. Some of the films give an excellent description of mining and transportation of iron ore to steel mills.

III — C. Foundry: The foundry offers a splendid way for boys to gain many experiences and to understand the great number of projects that depend on some form of casting. There is something very fascinating about molding, and boys enjoy working with it. The preparation of the sand and molding the pattern, use of cores, and pouring the molds, all offer valuable information that will give first-hand knowledge of how many of our tools and ornaments are made. After the casting is removed from the sand, it is ready to be finished. This will be done in III — A. Cold Metal, the III — D. Machine Shop. We find in most of the work that one division will overlap and furnish work for another. Some of the different kinds of projects will include paperweights, paper spindle, book ends, doorstop, boat keels. door knockers, small plaques, and other small castings. The school shop can use white casting metal, brass, bronze, aluminum, and pewter. The painting and decoration will come under the division of II — D. General Finishing.

III — D. Machine Shop: This work will be found mostly in the upper school and will draw from pupils who have had other metalwork experiences, as given in III — A. Bench Metal. The cost of equipping a machine shop is very great, since almost all the metalworking machines are of the precision type. The measuring devices, also, are very accurate, and require careful manipulation. The training experienced in the machine shop is very worth while and practical for the boy who expects to enter the industrial field. With some of

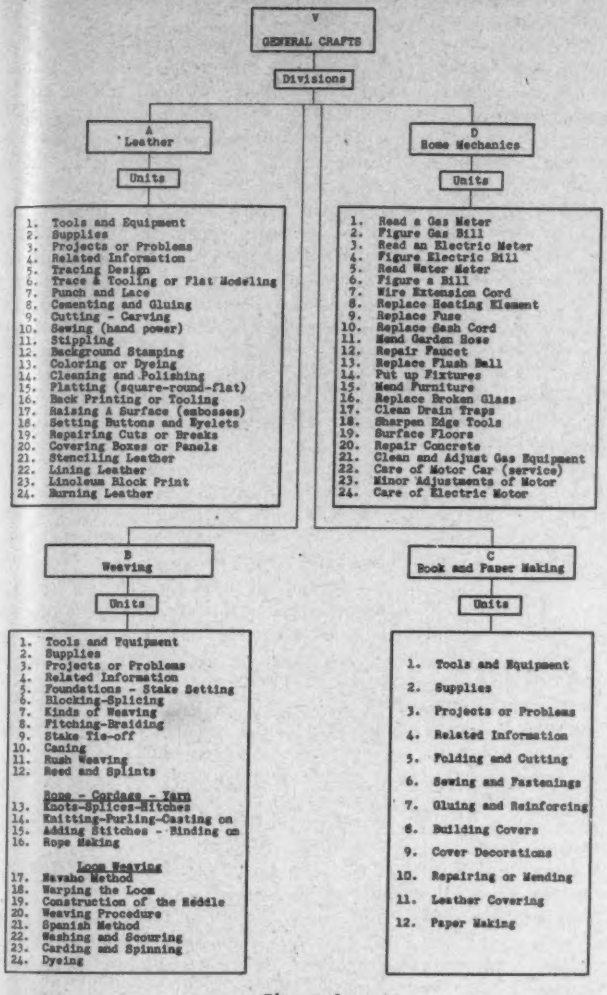

Chart 6

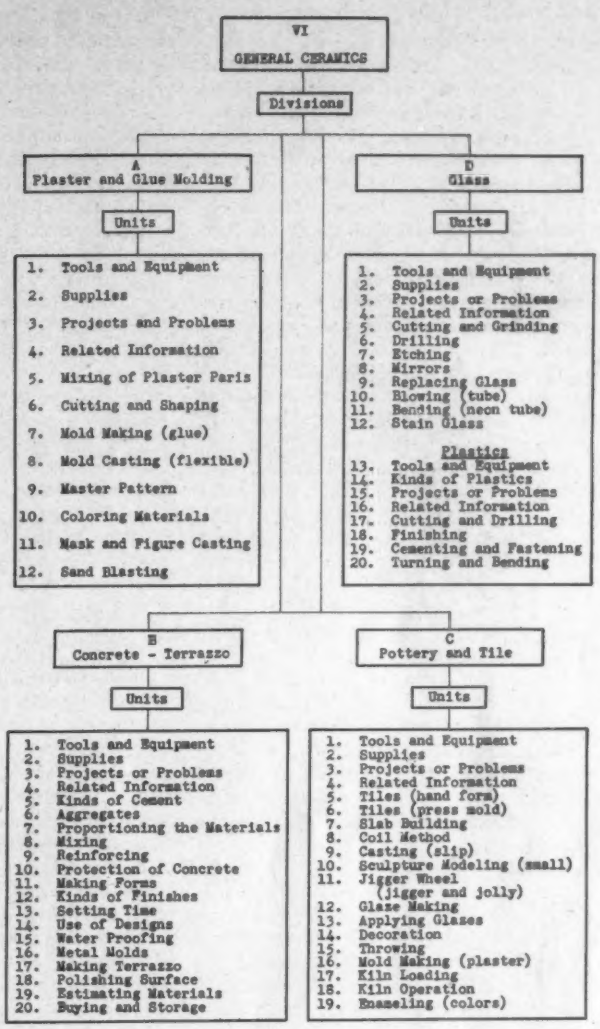

Chart 7

the less expensive, smaller type machines, such as the drill press, metal lathes, and grinders, this division has become an exploratory unit in the general shop program.

IV — General Powers (see Chart 5): The term power is a very broad one, and today one sees, feels, or hears it at all times. Life is so dependent on power of some type that when it is taken away for a short time there is a great loss. The part power plays in life is growing day by day. Through the development and uses of it, many people find gainful occupations; so power becomes a necessary requirement to assist pupils to explore and to find out how large a field this area really is, and how many possibilities power has to offer the coming generation. Time permits only a very limited discussion of the types of powers in the following four divisions.

IV — A. Electricity: The first division of the fourth area, namely, electricity, is one of the most interesting as well as the most useful to the pupil. With an electrified civilization, with all the motors of various sizes, heating apparatus, lights, bells, electric signs, transformers, and many other electrically controlled modern machines and devices, there is great need for practical and informational knowledge. The electrical field has much to offer as a challenge to the younger generation for further development. In view of all the different kinds of power machines and apparatus, everyone should know something about their care and safety for protection of himself and others. The lack of knowledge and the careless use of electrical power are the causes of many accidents and fires.

IV — B. Communication: Many boys are attracted at a very early age to some form of communication. The six-year-old youngster enjoys the small battery telephone with which he can communicate from the basement to the first floor of his own home. The training in Boy Scout organizations includes studies of codes that require building of telegraph sets, or some other type of flash system with different codes. After this development comes the crystal set, followed by the radio, and the broadcasting sets. This information and skill in building apparatus lead to the study of television, teletype, and other methods of communication. These units are very essential for the understanding of some of our many present-day mechanical achievements. They provide consumers with knowledge, and with this knowledge and ability, pupils can become intelligent buyers.

It should be kept in mind that the approach for the whole industrial-arts program is appreciational and avocational, rather than vocational, since the school must give a broad, clear picture of industrial arts as a helpful agent through which the pupil finds the work for which he is best fitted.

IV — C. Gas and Oil: Two additional sources of power that employ many people today, and that require much study to keep abreast of the newer types of motors, engines, and fuels, are gas and oil. The development of the auto and aeroplane motors in the past score of years leads to an appreciation of the necessity for training future leaders to work in these fields. Boys enjoy working with small motors of all sizes, miniature engines for airplanes, motor bikes, and small racing cars. The mechanical knowledge developed by working with the different kinds of power units gives a much keener appreciation of the better kinds and types of

equipment for personal use. In the past few years, new books have been written on the development and many uses of the Diesel power. Railroads, trucks, and power plants are already using this new power, the rapid development of which has well-nigh been spectacular.

IV — D. Water and Steam: The oldest types of power known, and which are still very much in demand, are water and steam. The large turbines used for developing electrical power are found throughout the United States, and larger ones are being planned and constructed. A project of water power is in the experimental stage in the state of Maine, where the tides will be used to supply power for the New England states. In some parts of the country, the old water wheels are still in use. Hydraulic power has many uses in our present-day industrial world, and is defined as a "science that deals with water and other liquids in motion."

V — General Craft (see Chart 6): The area of general crafts has several different divisions, with no relation to each other. In this area, the writer hopes to bring together the divisions that are not as large in scope as the divisions of the other areas, but are still of great importance.

V — A. Leather: Leather is a very old material used for both clothing and ornamentation. Its history proves very interesting to both pupils and adults. In this unit, the study of tanning and the selection of different kinds of leather provide the introductory information. Design, tracing, tooling, carving, repair, and other operations afford new and creative thinking, and offer many opportunities for the expression of artistic abilities. The leather industries provide work for many people, and it is through the knowledge and skill of these workmen that many different kinds of clothing are made available. The appreciation of quality in leather goods is helpful in choosing good merchandise for personal use.

V — B. Weaving: Under the division of weaving is found the study of textiles, kinds of materials, preparation, and processes of manufacture. In some of the eastern states the textile industries are of great importance. Here are found trade schools for training designers, loom operators, and other special workers of this great industry.

Art-fiber work is also a very popular type of work for schools. The student builds his base and forms in II — A (Wood) and does the final finishing in II — D (General Finishing) division. Along with art-fiber work, different kinds of caning can be taught most successfully.

V — C. Book- and Papermaking: Two very large industries in the United States, about which very little is heard in the industrial-arts program, are book- and papermaking. The history of the first making of paper is a very interesting story, and it traces various uses of paper down through the ages. The manufacturing of paper today is very different from the method used years ago. Immense quantities of paper are used for newspapers, wrappings, decoration, stationery, advertising, books, magazines, clothing, and shelter. There is a suitable paper for every need, from the very inexpensive to the most expensive. The meaning of rag content, 16- or 20-pound paper, water mark, kinds of paper for different types of printing, and the other methods of duplication listed under division I — B in the first area, should be known.

Bookmaking and repair, the binding of magazines, and other papers that are worthy of preservation, afford interesting projects that can be done in the shops. The study of various kinds of old books proves very interesting to many pupils. The working on the school annual is a fine experience in the making and planning of a book. Much of this work can be done in the shop, drawing, or printing room. The making of scrapbooks, stamp albums, and photo books are all projects that can be done very successfully in the industrial-arts department.

V — D. Home Mechanics: The division, Home Mechanics, is a series of units that pertain to the surroundings of the home in the way of making minor repairs. Labor, time, and expense are saved when some member of the family is able to make the repairs efficiently. Since the pupil can do many of these minor repairs, some method should be provided for giving him credit for the extra work and the information he has acquired. Since many of these odd jobs cannot be done in the school, a form is prepared on which may be given the description of the procedure and the parent's signature after the work has been completed successfully. This acts as a check for the teacher, as well as for the pupil. A pupil should be able to read a gas, water, or electric meter, check up or figure bills, replace a fuse, stop a leaking water faucet, replace a flush ball in flush tank, wax and polish hardwood floors, replace a broken glass, and do many other odd jobs as listed in Chart 6. This unit of home mechanics is a very popular course for both boys and girls.

VI — General Ceramics (see Chart 7): The sixth area, general ceramics, pertains to the clays and stones of various kinds refined in many different materials. The use of ceramics in many different forms can be traced back thousands of years, and acts as the best means of identifying the kind of civilization and the progress made from time to time. Crude forms of cement were found many years ago. Tile and brick were among the oldest building materials on record. Ceramics lends itself to both artistic and commercial use. Many new materials have been created in the past several decades.

VI — A. Plaster and Glue Molding: The making of plaques, the casting of statues and figure casting are examples of some of the ways plaster and glue molding may be used. The Bureau of Investigation and other criminal agencies have found these processes valuable in preserving records.

Since plaster works very quickly, there must be the knowledge of how to slow down as well as how to speed up the action of it. Plaster is used by the physician to hold broken bones while they heal, by the dentist to make molds for dental work, and by the artist to make molds from which he turns out models. The many beautiful decorations in public buildings are made from glue and plaster molds.

Glues are used in sand blasting designs and records in stone, and in carving difficult patterns of overcut edges. Pupils need to study the different solutions necessary to keep the plaster from burning the glue, and the method of reinforcing all types of plaster and glue molds. The method of mixing the plaster and pouring, the time for setting, and how to give hard surfaces a finish are all important steps in the work of plaster and glue molding.

VI — B. Concrete and Terrazzo: Concrete and terrazzo are mainly employed for commercial purposes, such as construction of roads, walks, buildings, foundations, floors, benches, flower boxes, urns, and surfaces exposed to hard usage and outside exposure. The terrazzo is made by adding colored stones to the cement, and after the compound has hardened, it is polished to a smooth, even surface. The pupil should become familiar with the different mixtures of cement and concrete, the length of time it takes to harden, and how to reinforce all kinds of work.

VI — C. Pottery and Tile: Pottery and tile are valuable assets to the cultural study of beautiful furnishing and decorating, for the same materials and processes are used to make useful ware of the more common kinds of clay products. The potteries that specialize in the ornamental products do not work with the cheaper wares. This division becomes a very interesting center in the school program. Both boys and girls find interest in working, modeling, and decorating the product. The experiences that come from the potter's wheel and the forming of beautiful clay objects by hand often become a hobby with many people. The making, the coloring, and the firing of tiles produce very beautiful results. Through their experiences, the workers will gain an appreciation of the many fine pieces made by different artists over the country, and will become able to judge quality in buying tableware and many other products of pottery and tile to be found in the home. Film slides afford much in the way of information for the schoolroom, and may take the place of a visit to the potteries. Some suggested projects are ash trays, fruit bowls, flower bowls, vases, cigarette trays, table tiles for hot dishes, and many small ornamental pieces.

VI — D. Glass and Plastics: A division that is a comparatively new field, although glass has been used many years by man, is glass and plastics. The demand for glass is growing rapidly and it is replacing other

materials. The knowledge of cutting, blowing, refinishing mirrors, drilling holes, and finishing edges afford many operations for the student. The bending of glass for tube signs is also an interesting process, but it requires a great deal of skill. The making and using of safety glass have become a very important part of the glass industry.

The color plastics are still newer in manufacture and use. This material comes in many colors and combinations of color. It is cut, sawed, drilled, turned, and polished. A number of interesting problems are made from this material, such as trays, rings, drawer pulls, curtain tiebacks, pins, buttons, napkin holders, card holders, trays, and cigarette and match holders. With this new material many colorful projects can be added to the industrial-arts work of the school.

Many of the materials listed in the different areas can be used together on different projects. This is one of the many reasons for a general shop.

Industrial-Arts Course in General Electricity for the Junior High School

TILDEN COLLAR*

At the present time there is a demand from industrial-arts teachers for a suggestive course of study with a definite guide to the selection, arrangement, and time allotment of teaching material.

The study of industrial arts may be defined as Dr. Frederick G. Bonser defines it: A study of the changes man makes in materials to increase their value, the appropriate use of products thus made, and the social advantages and problems resulting from the making of these changes and products.

The objectives have often been stated, and may be summed up as follows: To develop manual ability in the use of common tools that will help the pupil in his daily activities; to increase knowledge of industrial products and processes; to provide an opportunity for creative expression through the medium of tools and materials; to motivate interest in and increase knowledge about the fields of industry and the occupational opportunities related thereto.

These objectives can only be accomplished when the tools and materials are organized according to the processes, operations, and related lesson topics of the course.

Time schedule: The recommended time allotment per year for a good exploratory course in junior high school is 330 clock hours. The time should be divided between woodworking, electricity, metalworking, and printing in schools having unit shops.

This time allotment for general electricity has been developed on the assumption that other industrial-arts subjects will be given. So, in order to allow for them, only twenty weeks of work are outlined. Adjustments will have to be made to meet local conditions differing from this time allotment.

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Approximately 80 per cent of the time is to be devoted to processes and operations, and 20 per cent to related lesson topics.

Progression cards: The rule has been promulgated by the University of the State of New York that class and pupil records are essential to a thoroughly taught course of study. They should not be a burden to the instructor, but an aid to better practice. They are needed in all subjects and industrial arts is no exception to the rule.

The progression card furnishes the pupil with an excellent stimulus to self-appraisal. It also gives him a graphic statement of his own relative achievement. But, inasmuch as quality-ratings cannot be accurately given, due to the lack of standardized tests and measuring scales, it is believed that quantity records and interest records are most significant.

The trend toward objective grading, measurement, and evaluation of work performed, makes certain demands upon the industrial-arts teacher. He is expected to indicate excellence in performance through a five-point scale or a numerical rating. This material should be used by the administrator, teacher, parent, pupil, and guidance counselor as evidence in selecting or rejecting proposed courses in school, and possible life occupations. The correlation between interest and success makes accurate rating necessary.

Progression Card														
	Name								Class					
	Indicate absence and jobs in daily space													
1st quarter mark		1	2	3	4	5	6	7	8	6	27	28	29	30	31
	Feb.														
2nd quarter mark	Mar.														
	Apr.														
3rd quarter mark	May														
	June														
	Guidance information on back														

Five-Point Rating Scale

A	90 to 100
B+	80 to 89
B	70 to 79
C	65 to 69
D	Failure

Tools and operations: The operations of a trade are closely allied with the use of tools. The following list constitutes the operations each pupil is expected to perform satisfactorily. These operations form a minimum body of content but more may be added if it is deemed advisable.

Awl	to mark metal and start wood screws
Ammeter	to test dry cell
Brace and bit	to drill holes
Center punch	to mark metal
Countersink	for flathead screws
Compass	to test magnetic polarity
Flat file	to file flat surfaces
Hand grinder	to grind tools
Hack saw	to cut bar metal
Hand drill	to drill materials and wind coils
Knife	to strip insulation from wire
Plane, block	to square up board
Pliers, round-nose	to make wire loops
Pliers, flat-nose	to work wire
Punch	to punch holes in sheet metal
Rule	to measure to 1/16 inch
Soldering copper	to tin and solder
Saw, crosscut	to crosscut a board
Saw, rip	to rip a board
Try square	to square up a board
Screw driver	to drive screws
Tin snips	to cut sheet metal
Oilstone	to sharpen tools

Test lamp	to test circuits
Cold chisel	to cut metal
Wood chisel	to cut wood

Basic electrical processes: There is no sequence of difficulty in the listing of the processes, but the processes may be selected by the instructor according to their difficulty. Demonstration of the processes may be given as often as necessary.

The teacher should, however, keep in mind that the development of skill comes through the repetition of the processes involved in the sequence of projects throughout the term and not through formal drill exercises. Careful work is necessary, but a high degree of skill is not to be expected in connection with the construction of projects at the junior high school level.

1. Fasten a wire under a binding post.
2. Fasten a bell wire with staples.
3. Straighten a kinked wire.
4. Tie an underwriter knot.
5. Make a helix.
6. Make a Western Union splice.
7. Make a pigtail splice.
8. Make a tap splice.
9. Solder and tape splices.
10. Wind a coil with magnet wire.

Individual projects: In general, the following projects and related lesson topics have been set up parallel to the operations and processes which the pupils will perform in the construction of their projects. A demonstration of any of these processes and operations calls for a definite manual exhibition on the part of the instructor, and cannot be adequately presented through a lecture or shop talk. It is essential that the pupil actually see the operations properly done. The related lesson topics, however, may be presented during the manual exhibition, or separately during a shop talk.

1. *Bell and signal circuits:* (*a*) electromagnet; (*b*) permanent magnet; (*c*) simple bell circuit showing source, path, control, and load; (*d*) telegraph circuit with strap key and sounder; (*e*) simple burglar alarm with switch; (*f*) annunciator circuit.

2. *Light circuits and household appliances:* (*a*) signal lamp; (*b*) book lamp; (*c*) extension trouble lamp; (*d*) desk lamp; (*e*) wall lamp with single-pole switch; (*f*) test lamp; (*g*) extension cord; (*h*) cord for electric iron.

Group projects: (*a*) model arc light; (*b*) crystal radio set; (*c*) one-tube radio set; (*d*) wattmeter model; manually operated dials; (*e*) models for science correlation; (*f*) elementary ignition system; (*g*) repairs to shop equipment and material; (*h*) electric stove and toaster; (*i*) electric questionnaire; (*j*) transformer; (*k*) two-point switch and circuit; (*l*) two-point control circuit.

Related lesson topics: Through the medium of related lesson topics the teacher enriches the background of the pupil with information affiliated with his manipulative activity in particular and with industry in general.

The related lesson topic preferably should be presented to the class in the last ten minutes of the shop period with a teaching plan known as a shop talk. The shop talk is not a lecture. It is in the nature of a discussion in which the pupils take part. The teacher starts it by presenting a problem to the class, and ends it by a summary of the facts.

1. *Design:* (*a*) importance of neatness; (*b*) proportion and arrangement; (*c*) good design as applied to projects.

2. *Interpretation of blueprints:* (*a*) how to read simple blueprints; (*b*) how to interpret electrical symbols.

3. *Sketching:* (*a*) how to sketch simple circuits.

4. *Mathematics:* (*a*) how to read a rule to 1/16 inch; (*b*) how to find current in amperes by Ohm's law; (*c*) how to find voltage by Ohm's law; (*d*) how to find resistance by Ohm's law; (*e*) how to figure watts, kilowatts, and kilowatt hours; (*f*) compute the cost of operating an electrical appliance.

5. *Economics:* (*a*) effect of electricity on travel by train, ship, and automobile; (*b*) effect of electricity on the home: appliances; lighting, heating, air conditioning, refrigerators.

6. *Science:* (*a*) laws and uses of simple magnets; (*b*) lighting and electricity; (*c*) magnetism and the motor; (*d*) chemistry of battery cells; (*e*) heat developed by electricity; (*f*) material used for conductors and insulators; (*g*) the operation of spark plugs; (*h*) direct-current — alternating current — cycles.

7. *Geography:* (*a*) sources of material used in electric circuits; (*b*) effects of electricity on location of manufacturing centers.

8. *History:*

a) Static electricity was known quite early in history. When amber is rubbed with wool it attracts pieces of pith or paper, due to a charge of electricity. This effect of electricity was discovered in ancient Greece by Thales, 600 B.C.

b) The magnet was discovered in 300 B.C. in the city of Magnesia, in Asia Minor, and it is from this city that it gets its name.

c) Natural magnets found their first use in the compass. They were called loadstones. The word *loadstone* means leading stone. The natural magnet was called a loadstone because it had the power through its polarity to lead one in any desired direction.

d) The word *electric* was first used in a book published in the year 1600 by Sir William Gilbert, physician to the Queen of England. It springs from the word *elektron*, which is Greek for amber.

e) The first condenser was known as a Leyden jar. It was discovered accidentally at the University of Leyden, in Holland, by some students who were attempting to put electricity in a bottle of water. This discovery was made in the year 1745.

f) Benjamin Franklin, in the year 1752, with the aid of a copper key, a kite string, and a Leyden jar, collected electricity from the clouds, thus proving that lightning and electricity are the same. From the knowledge gained thereby he invented the lightning rod.

g) In the year 1799, Allesandro Volta discovered current electricity and made the first battery. Volta's experiment, by providing a means of producing current electricity, opened up to science a great field of investigation. This led to the discovery by Hans Christian Oersted, 1819, that a magnetic needle could be influenced by a wire carrying a current of electricity, and resulted in the invention of the electromagnet by Joseph Henry.

h) When Joseph Henry learned that an electromagnet would attract a small piece of iron with a sharp click, the idea of the telegraph was born. In 1838, Samuel F. B. Morse first demonstrated to the general public his electric telegraph. Messages were sent over three miles of wire stretched around the walls of the Speedwell Iron Works, Morristown, N. J.

i) The electromagnet also led to the discovery that electricity could be produced by magnetism. Michael Faraday, who made this discovery, 1839, is credited with the invention of the first generator.

j) Alexander Graham Bell discovered the principle of the telephone in 1875. His continued experiments, based on his discovery, resulted in an instrument that really *talked.*

k) In 1879, Thomas A. Edison invented the first incandescent lamp, and needed an improved form of constant-voltage generator to furnish the current. Accordingly, he designed and built a power plant with generators, regulators, meters, and other parts of a complete electric system.

l) Radio is probably the greatest electrical development of modern times. It was made possible by the discovery of radio waves by Hertz. Many other men, however, had a part in the development. Marconi erected the first transmitting and receiving stations; Tesla invented the original sending coils; Edison, Fleming, and DeForest developed the radio tube; and Armstrong invented many modern sending and receiving circuits.

9. *Occupational information:* (*a*) Occupations in the electrical field: light, heat, power; telegraph, telephone, radio; water-power construction; Army and Navy; Civil Service. (*b*) Working conditions, hours, and wages.

10. *Sociology:* (*a*) the national electrical code; (*b*) the local electrical code; (*c*) the purposes of the trade-union.

11. *Safety education:* (*a*) dangers in the electrical trade; (*b*) shop conduct and care in using tools; (*c*) the use of the first-aid cabinet; (*d*) danger of burns and their treatment; (*e*) safety in testing circuits; (*f*) proper method of handling acids; (*g*) the hazard of fire from electricity; (*h*) what to do for a victim of electric shock.

12. *Electrical theory:*

a) The electric circuit, the source of current, the path of current, the control of current, and the use of current.

b) *Conduction:*
Good conductors of electricity
Materials in common use
Resistors: Material commonly used. Heating effects. Everyday use of this effect.
Nonconductors: Materials commonly recognized. Special value of nonconductors.

c) *Generation of electric current:* Chemical generators:
Dry cells — zinc, carbon, and medium.
Storage cells: container, plates, solution, and action.
Magnetic generators: dynamos, magnetos.

The First Day in Shop

Problem: (*a*) How shop is organized.

Preparation: (*a*) pupils take seats on workbenches; (*b*) appointment of first tool monitor; (*c*) appointment of two workbench monitors.

Demonstration: (*a*) how tools are issued; (*b*) how tools are accounted for; (*c*) how to make progression card.

Summary: (*a*) Outline of all related lesson topics to be covered.

Shop Talks

Shop talks should be carefully planned. They are not to be mere lectures. They should be so presented as to draw upon the observations and experiences of pupils to enlist their active participation.

The following is a suggested shop talk for related lesson topics.

1. *Subject:* Conductors and insulators
2. *Problem:* How may insulators be readily distinguished from conductors?
3. *Discussion:*

a) Material obtained from minerals: gold, silver, copper, iron, etc.

b) Material obtained from living matter: coal, oil, wood, rubber, leather, cloth, etc.

c) Material obtained from rocks: slate, marble, glass, etc.

4. *Summary:* Material commonly used for conductors, insulators, and resistors: size, form, design and finish.

Suggested Teaching Plan

1. *Motivation:* Arouse an interest and a desire to construct the object by drawing upon pupil experiences, interests, and needs. Present models and illustrations. This procedure is basic for all projects.
2. *Preparation:* Discussion of the elements involved: purpose, materials used, size, form, design, and finish.
3. *Demonstration:* The demonstration should be a manual exhibition showing the use of tools, instruments, and equipment.
4. *Individual instruction:* The teacher should check the work frequently to develop habits of neatness and accuracy. Redemonstration of processes should be resorted to as often as necessary.
5. *Safety:* All safety factors should be carefully explained and demonstrated.

Shop Maintenance

1. *Teacher:* All projects and tests should be carefully inspected by teacher.
2. *Pupil participation:* Pupils to take turns in charge of toolroom. Pupils to take turns as bench monitors to clean benches.
3. *Shop organization:* As a general rule the first ten minutes should be devoted to project demonstrations, and the last ten minutes to shop talks.
4. *Shop safety:*

a) Use of cutting tools, such as knives, chisels, and planes.

b) Proper handling of insulation and grounds.

c) Proper handling of acids.

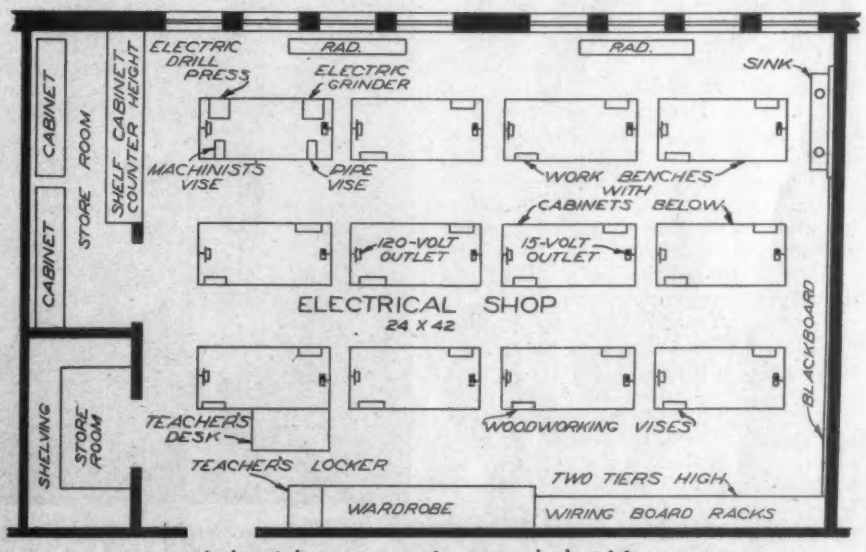
Shop Layout and Equipment

1. *Size of room:* 24 by 42 ft.
2. *Accommodation:* 20 pupils
3. *Location:* On first floor
4. *Shop layout:* As outlined on layout plan
5. *Equipment:*

1 Teacher's desk
1 Teacher's locker
1 Toolroom
2 Tool cabinets
1 Storeroom with 18-in. shelving
1 Shelf cabinet — counterheight
1 Children's wardrobe
1 Sink, 5 ft. long; 2 outlets, one to be drinking bubbler
1 Shelf over blackboard 18 in. wide for finished projects
12 Bench outlets as outlined on plan — 15 volts
12 Bench outlets as outlined on plan — 120 volts
1 Waste can
1 Wiring-board rack
40 Wiring boards
1 Drill press as outlined on plan — electric drive
1 Grinder as outlined on plan — electric drive
1 Pipe vise as outlined on plan
1 Machine vise as outlined on plan
22 Wood vises as outlined on plan
1 Blackboard
12 Wodworking benches (26 by 56 by 30 in.) as outlined on plan
1 First-aid kit (12 by 18 in.)

Tools

12 Oilstones, 2 by 8, without case
12 Snips, side
12 Knives, sloyd
12 Try squares, 6 in.
2 Oilcans, 3½-in. spout
12 Awls, 3/32-in. point
12 Bits, augur, No. 10
12 Bits, augur, No. 6
12 Bits, reamer, ½ to ⅜
12 Bits, twist, 8/32
12 Bits, twist, 2/32
12 Bits, countersink
8 Braces, 8-in. swing
12 Chisels, wood, ½ in.
1 Dresser, emery wheel
8 Drills, hand, ½-in. shank
12 Drill points, No. 7
6 Files, augur bits 7 in.
12 Files, flat, bastard 10 in.
1 Gauge, B and S
12 Hammers, brad
12 Cutters, block plane
12 Planes, block
1 Plane, smoothing
1 Plane, combination
12 Pliers, flat-nose
12 Pliers, round-nose
12 Saws, back
4 Saws, rip
4 Saws, crosscut
4 Saws, hack
12 Saw blades, hack
12 Screw drivers, 4 in.
2 Nippers, end
1 Stock and die set, pipe, ⅛, ¼, ½, ¾



Industrial-arts course in general electricity

1 Stock and die set, bolt, ¼, ⅜, ½
1 Stock and die set, machine screw, 4–32, 6–32, 8–32, 10–32
1 Torch, alcohol
1 Torch, gasoline
12 Soldering coppers
1 Punch, Kalox, OX, small
1 Bit, expansive
1 Storage battery substitute
10 Punches, center

Supplies

100 Bells, vibrating
100 Door spring buttons, circuit closed when button is out
100 Sockets, key, ⅛ cap, 250 volts
10 lb. Staples, ½ to ¼ in., coppered
50 Rolls, tape, friction
10 lb. Soldering salts
2 Sheets, steel, No. 28, 30 by 96
2 Sheets, steel, No. 26, 30 by 96
20 lb. wire, annunciator
20 lb. wire, d.c. No. 20, magnet
20 lb. wire, d.c. No. 22, magnet
20 lb. wire, d.c. No. 30, magnet
300 ft. lamp cord, No. 16
10 boxes screws, r.h., 6–32, ¼ in., machine
10 boxes screws, r.h., 6–32, ¾ in., machine
10 boxes screws, r.h., 4–32, ¾ in., machine
10 boxes nuts, 6–32, machine
10 boxes nuts, 4–32, machine
100 Plugs, attachment
100 Plugs, electric iron
100 Plugs, connector
100 Switches, lighting, feed through
100 Receptacles, porcelain, miniature
10 boxes stove bolts, f.h., ¼ by 1 in.
10 boxes stove bolts, r.h., 3/16 by 1 in.
100 Buttons, door, two-point
10 lb. wire, solder, rosin core
50 sq. ft. transite board

First Aid to the Injured

The three things you should remember in case of serious accident are these: *keep cool, keep the crowd away, send for a doctor.*

In the meantime do what you can to help the victim.

Shock is present in all serious injuries and greatly increased by bleeding and pain. Lay patient on back with head low, loosen clothing about neck and abdomen. Keep patient warm with hot water bottles and blankets. If he can swallow, give him hot milk, or hot water, and a half teaspoonful of aromatic spirits of ammonia in water.

Note: Never pour liquid down the throat of an unconscious person.

Bleeding can usually be stopped by placing small pad of gauze over wound, and wrapping with a tight bandage.

Electric shock: Quickly release victim from current, using dry nonconductor (rubber gloves, several thicknesses of newspaper, dry clothing, wool or felt hat wrapped around hand, or use a rope or board). Beware of using any metal or moist material. If possible, shut off current.

Summary of Function, Purpose, Aim, and Outcome of Shopwork in Junior High Schools

The function of industrial arts in junior high school is exploratory, not vocational. It assists largely in the work of guidance. It seeks:

1. To meet the needs of pupils, recognizing their individual differences.
2. To discover and develop the pupils interests, skills, and attitudes.
3. To supply opportunities to explore certain major occupational fields, and to give the pupils an elementary knowledge of the major activities of our work-a-day world outside the school.
4. To develop ability to make worth while use of leisure.
5. To supply information concerning the principal occupations of our city and its environs, opportunities for employment and advancement, remuneration, periods of active work, industrial accident and health hazards.
6. To create and develop the recognition of the dignity of, and necessity for the worker regardless of his occupation.
7. To make the pupil familiar with the common tools and processes basic in most occupations.
8. To give a knowledge of the raw materials of industry, their source and preparation for use, their commercial and economic value.
9. To teach the value of good design in construction consistent with the purpose, use, material used, and durability.
10. To develop a sound consumer attitude in judging the utility, quality, and cost of industrial products.
11. To develop habits of accuracy, neatness, precision, orderliness, and honesty in workmanship.
12. To note the formal knowledges and skills of academic subjects needed for industrial-arts activities such as technical spelling, knowledge of fractions, and scientific principles.

Information Content References

1. *Rewinding Small Motors* by Braymer and Roe (New York City: McGraw-Hill Publishing Company).
2. *Electroplating* by Field-Samuel-Weill (New York City: Isaac Pitman & Sons).
3. *Radio Receiving Tubes* by Meyer (New York City: McGraw-Hill Publishing Company).
4. *Small Motors, Transformers, Electromagnets* by Stoller (Chicago, Ill.: American Technical Society).
5. *Job Sheets for the Practical Electrical Shop* by Tustison (Milwaukee, Wis.: The Bruce Publishing Company).
6. *Electrical Things Boys Like to Make* by Cook (Milwaukee, Wis.: The Bruce Publishing Company).
7. *Electricity, A Study of First Principles* by Burne (New York City: D. Van Nostrand Company).
8. *Signal Wiring* by Croft (New York City: McGraw-Hill Publishing Company).
9. *Wiring for Light and Power* by Croft (New York City: McGraw-Hill Publishing Company).
10. *American Electrician's Handbook* by Croft (New York City: McGraw-Hill Publishing Company).
11. *A Primer of Blueprint Reading* by Diamond (Milwaukee, Wis.: The Bruce Publishing Company).
12. *Blue Print Reading* by Dalzell-McKinney-Ritzow (Chicago, Ill.: American Technical Society).
13. *Electrical Laboratory Tests* by Johnson and Earle (New York City: D. Van Nostrand Company).
14. *Essentials of Applied Electricity* by Jones (Milwaukee, Wis.: The Bruce Publishing Company).

Tin-can projects. Photograph submitted by Sylvan A. Yager, Indiana State Teachers College, Terre Haute, Ind.

Model Aircraft Program Proves Educational

CHRIS H. GRONEMAN*

During the past two years, the Bureau of Aeronautics of the United States Navy in cooperation with the United States Office of Education in the Federal Security Agency has requested schools to assist in the model airplane building movement. The cooperating schools have been supplied scale model drawings in various descriptions of practically every type plane, allied and foe. This program has recently been officially closed by Washington authorities.

The purpose of this movement has been to supply models to serve as recognizing instruments in training personnel of the air forces of the Army and Navy. Thousands of models have also been built and made available for the Civil Aeronautics Authority for their civilian pilot training division. Recently the high school preflight courses have asked for the same type models. The model aircraft program has been made an accredited division in the High School Victory Corps which has become increasingly popular with students.

School administrators, in most cases, are of the opinion that this project has provided special educational values and they have been cooperating most enthusiastically with the various State Departments of Industrial and Vocational Education. The series of model planes which the various agencies have requested for the two years were explicitly detailed with illustrative material which has been prepared by authorities in the United States Office of Education. Dr. J. C. Wright, Assistant Commissioner for Vocational Education and Director of the Model Aircraft Project states, "Not least among the motives in inspiring the youths to the painstaking work required in building these planes has been the realization that the planes are to be used by our fighting men, and that instant recognition of a plane means the difference between life and death for one of our airplane crews."

Considerable time and money has been invested in developing the materials which were contained in the kits available to all interested people. This information consisted of "Scale Model Aircraft Construction Procedure," a 24-page booklet containing over fifty illustrations and valuable instructional material on building, teaching, and promotion. To make certain that the planes were built to desired specifications, there was provided a complete set of full-size templets of all parts on manila cardboard. Each of the many types of planes had profusely illustrative job sheets which contained identification and recognition symbols. Each plane was illustrated in a pictorial view listing the names of the parts. The procedure chart illustrated the basic and essential steps in construction. This material was of special value to students as well as to teachers.

To assist the teachers in promoting the program, a special leaflet describing quotas, inspection committees and methods of packing and shipping scale models was included. The system of certification and awards was explained to show the ranks which a student might attain. Certificate awards were presented to students who merited them. At the close of the first year, only four boys in the nation achieved the rank of Admiral Craftsman, meaning that each completed the entire series of fifty acceptable planes. Participating teachers and school administrators have reported that only the older and the best trained shop students were capable of building a satisfactory and acceptable model.

Recently a study was made to analyze the operations and types of information necessary in constructing aircraft models. It was interesting to learn that an appreciable number of the industrial-arts objectives were realized. The following analysis clearly indicates that the students who attempted to build a model must have been able to do many operations and needed to have considerable information. Before attempting to build a plane, it was necessary that a student know how to interpret a two- and three-view drawing and the pictorial sketches. The builder was acquainted with the purpose of model aircraft in the armed forces and was able to identify the many parts of a plane. It will be noted under Part B, Detail Construction, that he must have had much information before attempting the numerous operations in building the many parts. Much accuracy was required for the Assembly, Part C, and in the techniques of setting up jigs. When the teacher desired to acquaint the student further with aircraft, considerable reliable information was provided under Part D. After the student completed one or more models, he should have been able to use intelligently a vocabulary of approximately sixty new words and terms. He also had opportunity to use many of the essential hand tools which are commonly used in the industrial-arts laboratory or shop.

Those who have been interested in the model aircraft program can readily understand that this project was well adaptable to the average shop and laboratory courses. The following list of operation and information topics implies this fact.

*Acting Head of Industrial Education Department, School of Engineering, A. & M. College of Texas, College Station, Tex.

Analysis of Operation and Information Units in Constructing Model Aircraft

These units to be used in conjunction with *Scale Model Aircraft* Construction Procedure: (Bureau of Aeronautics, U. S. Navy Handbook)

Operation Units *What the student should be able to "Do"*	*Information Units* *What the student should "Know"*
A. *Preliminary Steps*	
1.	1. Purposes of model aircraft in the armed forces
2.	2. Identification of parts pertaining to the plane
3.	3. Interpret a two- and three-view drawing
4.	4. Interpret a pictorial drawing or sketch
B. *Detailed Construction*	
5. Make the necessary templates	5. *a*) Method of laying out *b*) How to transfer from drawing *c*) Materials used for making templates (paper, cardboard, and sheet metal)
6. Select desirable woods	6. Study of woods best suited for scale model construction (soft or hard — closed or open grained)
7. Mark fuselage according to template	7. *a*) Method of marking around templates *b*) How to fasten template while marking
8. Cut fuselage to shape with a scroll or jig saw	8. *a*) Adjustment of scroll or jig saw *b*) Coarseness of blades
9. Lay off center line on fuselage block	9. Purpose of center lines for locating template position

Operation Units	*Information Units*
10. Rough out stock with drawknife	10. *a*) How to use drawknife *b*) Safety precautions *c*) Care of drawknife
11. Carve with penknife	11. *a*) Description of knife *b*) How to hold knife for whittling *c*) Safety precautions *d*) How to sharpen
12. Smooth with block (or model) plane	12. *a*) Kinds of model planes *b*) How to hold plane *c*) How to adjust block and model planes *d*) How to sharpen plane blade
13. Smooth with rasp or file	13. *a*) Types and grades of rasps and files *b*) How to file
14. Check shape of fuselage with cross section template	14. *a*) Purpose of checking cross section *b*) Method of obtaining template shape (section view) *c*) Materials used for contour checking (iron wire, lead solder, and aluminum wire)
15. Smooth with sandpaper	15. *a*) How to hold sandpaper on block *b*) How to sand *c*) Types and grades of abrasives for sanding *d*) How to make forms for sandpaper blocks
16. Lay out wing taper	16. *a*) How to lay out wing taper *b*) Why wings are tapered *c*) How taper is transferred from drawing
17. Lay out wing shape with use of template	17. *a*) Types of wing outlines *b*) How to use wing templates
18. Shape wing airfoil	18. *a*) How to lay out airfoil *b*) Types of airfoils *c*) Purpose of airfoils
19. Bevel dihedral joints	19. *a*) Definition of dihedral *b*) Types of dihedral joints *c*) How to fit joints
20. Glue dihedral joint with aid of jig	20. *a*) Purpose of jigs and gauges *b*) How to make jigs and gauges

Operation Units	*Information Units*
	c) Method of holding joints
21. Mark and score surface for control places	21. *a*) Method of scoring *b*) Definition and purposes of aileron, elevator, and rudder
C. *Assembly of Parts*	
22. Glue parts together	22. *a*) Kinds of and materials for glues suitable for model building *b*) How to hold parts while gluing
23. *Fairing* or forming fillets	23. *a*) Materials used for fairing (putty, plastic wood, plaster of paris, stick shellac, glue and chalk, and glue and sawdust) *b*) Purpose of fairing on full-size aircraft *c*) Where and how to put on fairing
24. Fill pores of the wood	24. *a*) Kinds of fillers *b*) How to make *c*) How to apply
25. Final sanding of completed model	25. Grade of sandpaper for final sanding
26. Apply the finish	26. *a*) Kinds of paint best suited for model aircraft *b*) Ingredients of paint *c*) How to apply paint *d*) How to care for brush
27. Mark for identification and shipment	27. Kinds and purposes of labels
D. *Additional Related Information*	
28.	28. Identification and proportions of various types of aircraft
29.	29. Relationship of various parts of the ship to each other
30.	30. Functions of the various parts while ship is in flight
31.	31. History of aviation
32.	32. Modern aviation for transport facilities
33.	33. Future trends in aviation
34.	34. Occupational opportunities directly and indirectly associated with aviation

Technical Vocabulary

The following list contains some of the more common words or terms which the student or novice will encounter in the construction, identification, and inspection of his first plane. Many words were common to him before this experience but the meanings will possibly differ:

1. aerial
2. aileron
3. airfoil
4. anneal
5. assembly
6. bevel
7. blister
8. carrot-type
9. cockpit
10. concave
11. contour shape
12. control surface
13. counterbore
14. dihedral
15. dorsal turret
16. elevator
17. engine cowling
18. fairing
19. fillet
20. fin
21. flap
22. float
23. fuselage
24. gauge
25. greenhouse
26. gull
27. hub
28. jig
29. knee
30. knots
31. landing gear
32. lead
33. midwing
34. nacelle
35. navigation
36. nomenclature
37. outline
38. parasol
39. pith
40. pitot tube
41. precision
42. propeller
43. radial cowl
44. retractable
45. rudder
46. sap
47. seasoned
48. silhouette
49. span
50. spinner
51. stabilizer
52. tail
53. taper
54. template
55. tolerance
56. tongue depressers
57. trail
58. translucent
59. turret
60. undercarriage

Essential Hand Tools

A list of the more common laboratory or shop tools with which the student makes contact. Proper use of each is important in teaching any skill:

1. backsaw
2. coping saw
3. crosscut saw
4. drawknife
5. drill bits
6. electric burning needle
7. hammer
8. hand drill
9. jack or smooth plane
10. jeweler's file
11. marking gauge
12. model plane
13. nail set
14. paint brush
15. penknife
16. pencil
17. rabbet plane
18. razor blade
19. ripsaw
20. rule or straight edge
21. sandpaper or emery cloth
22. scriber
23. spoke shave
24. T bevel
25. try square
26. wood chisel
27. wood rasp or file

28. tin snips, pliers, scissors } template making

Power Tools

1. band saw
2. jig or scroll saw
3. universal table saw
4. wood lathe

YOUR PART

Leonard E. Schmidt*

Now that our country is at war,
Things must last longer than before;
Be sure to treat that lathe "just right,"
Another one is not in sight.

The spoilage on the jobs you do
Should all be saved when you are through,
For it is needed in the fray
That will bring peace again some day.

In doing things like this you'll mold,
Habits worth their weight in gold,
And Uncle Sam will thank you too;
In helping him, you're helping you.

*Lincoln Hall Vocational Shops, Lincolndale, N. Y.

Work is the essential part of life and nothing worth having comes without it. Everything costs something in effort or sacrifice. Health comes from habits of right living, and that means restraint; wealth comes from persistence and energy, and that means labor; education comes from application and industry, and that means discipline; happiness comes from consideration of others, and that means unselfishness. — *Charles Pratt,* founder of the Pratt Institute.

Teaching Drafting

ARTHUR A. DICK*

The opinions expressed in this article are in reference to the average drafting course on the high school level. Also, the term *drafting* is used in preference to *mechanical drawing* because many of the elements involved in present-day drawing are not purely mechanical.

Today great emphasis is placed on the teaching of blueprint reading and sketching. This trend is definitely the result of industrial influence and needs.

Map making and interpretation also have become important units in the drafting course because of the military aspect of the times. Then there has been a notable increase in the use of isometric and other forms of pictorial representation as a means of aiding productive procedures especially in the aircraft industries. As a result, there is already evidence that instructors of drawing are teaching pictorial representation at the start of a course rather than later on as has been the conventional practice in the past.

Following are some of the writer's opinions in regard to the philosophy of teaching drafting.

Teaching procedure: Just telling a student is not enough. It is commonly known that students retain a very small part of a lecture. To rectify this, tell the student either by the group method or individually, and then have him *perform*.

A beginning student may be told that a vertical line is drawn by the use of a T square and triangle. However, if the student does not know what a vertical line is, no amount of telling will help him to perform this specific operation.

Too often instructors take for granted that a student possesses certain knowledge. It is dangerous to take anything for granted, however, and only the most careful planning by the teacher will insure good instruction.

Have the teaching material organized into small units which can be easily handled and utilized, and teach these small units thoroughly. Use them in a sequential order, as steppingstones, and tie them up with the desired associations by means of related information. Check student progress by testing, questioning, and observation at frequent intervals.

It is felt that the experienced drafting teacher should correct a student's drawing as soon as it is finished in pencil. This procedure is in variance with the practice of many drawing teachers. Some of the reasons advanced by the writer to substantiate the policy of correcting drawings immediately upon completion are:

1. This is industrial drafting room practice.
2. It gives an opportunity to correct the drawing with the student participating.
3. Much worth-while and effective individual instruction can take place.
4. This can be an opportune time for remedial instruction because the student and the situation are still "warm."
5. Time can be saved as the student can continue with the same drawing or start a new one.
6. One drawing is completely finished and checked before the student starts on a new drawing. Also, the student can profit immediately from the suggestions and corrections.

Drafting Class Organization

Take five to ten minutes of each hour for organized and preplanned related instruction, to be given to the whole group. This procedure gives the instructor a *hold* on his class. Do not have any instruments or drawings available to the students during this instruction or their interest may be diverted. This related instruction may be information on mathematics, science, mechanics, tests, visual aids, and the like, as they apply or are associated with drafting.

Prepare a minimum contract with the class in the form of a required number of drawings. Each student should have a copy of this contract at the beginning of the course.

Let each student progress at his own rate provided his drawings meet an acceptable standard. Provide extra problems for the superior student, or better still, let him select his own problem.

It seems to be good policy to have all visualization problems solved by the student in orthographic projection through the means of freehand sketching. After the sketch is checked by the instructor, a mechanical drawing can be made with a pretty good idea that it will be acceptable as to rules of drafting.

Keep a progress chart on the bulletin board for each drawing class, and record each student's progress carefully upon it. It is generally accepted that a progress chart can be an excellent motivating device.

Use the interest and socializing factors whenever possible. Some of the usable ones are:

1. Present and display blueprints and drawings from industry.
2. Assign reports, oral and written on drafting topics.
3. Exhibit and explain drawings of past and present classes.
4. Have draftsmen and engineers speak to your class.

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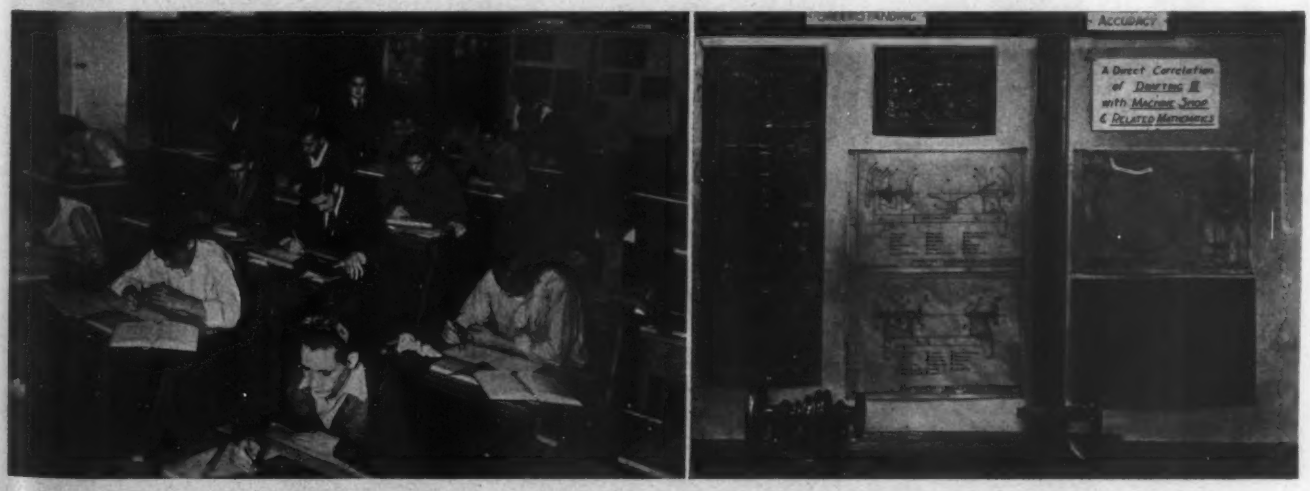
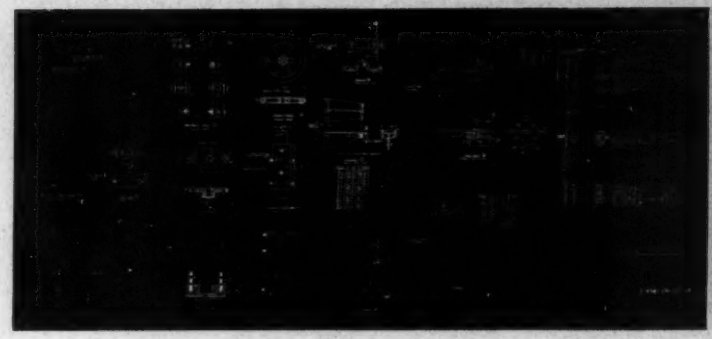


Drafting room, blueprints, and bulletin board display



Industrial blueprints. Details

Industrial blueprints. Ship sections

5. Take a field trip to an industrial drafting room. (This may be difficult during wartime.)

Lettering. The instructor must form his own ideas about trends in drafting, lettering, and the like. Students should learn to letter correctly from the very beginning. The type of lettering should be simple and basic so that later the student can easily switch to other types of lettering as the occasion demands. It is felt that the student should have his choice as to whether he prefers vertical or slant lettering. Some teaching points which are helpful in teaching lettering are as follows:

1. Use light guide lines in pencil for lettering.
2. Poor lettering can ruin the appearance of a good drawing.
3. To be able to letter well takes a great deal of practice in most cases.
4. To learn how to letter, take plenty of time at the start. Observe carefully the technique of forming each letter. Speed will come naturally after the fundamentals are mastered.

Inking. Some inking is justified in a drafting course because it gives the student an opportunity to learn a definite technique. Also, while he is inking a drawing the student gets an opportunity to recapitulate. The fundamentals and associations of drawing can be absorbed only at a given rate. This is on the same principle that it is not logical to teach a year's course in algebra in half a year. Inking is still practiced in some industries, especially on tracings which are to be saved and stored for some time.

Industrial practice. The progressive drafting teacher should keep in touch with industrial trends. Working in an industrial drafting department during the summer vacation is certainly to be recommended.

Drawing axioms may change or become obsolete as illustrated in number 1 and 2 of the following:

1. Use a tack puller for removing tacks.
2. Do not use your scale or triangle for removing tacks.

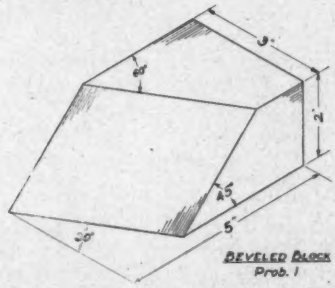
General industrial practice makes use of drafting tape or staples, instead of tacks for holding down paper.

3. Use your scale only for measuring. Never draw lines with your scale.
4. Keep your hands and instruments clean.
5. Use a sharp pencil for clear legible lines.

In school practice the student is taught to use the head of the T square against the left edge of the drawing board. But it should also be explained that on large drawing tables in industry, the head of the T square may be used from the bottom edge of the table.

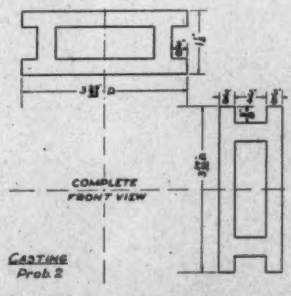
Practical and challenging problems. Drawing problems must be carefully selected with the idea in mind to meet certain educational objectives. The following six problems illustrate basic possibilities in problem selection and instructional development:

Prob. 1. *Beveled Block:* Draw three views in orthographic projection: front, top, and left side.

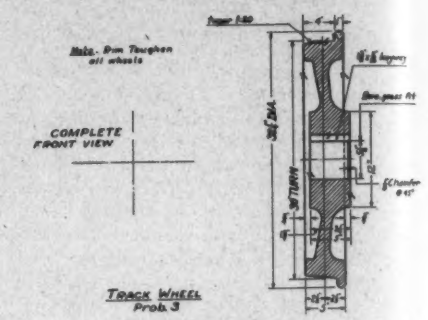


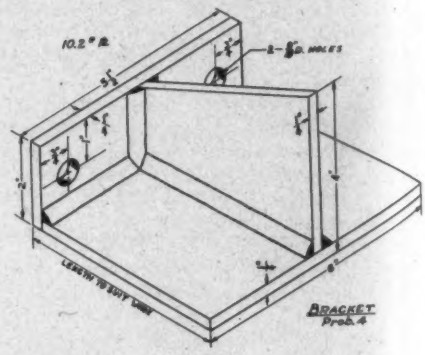
Prob 2. *Casting:* Complete the front view. (This is a problem in visualization. Only two views would be used in practice.)

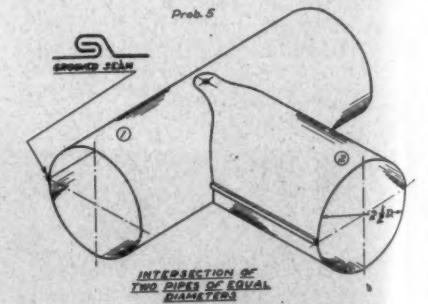
Prob. 3. *Track Wheel:* Complete the front view.

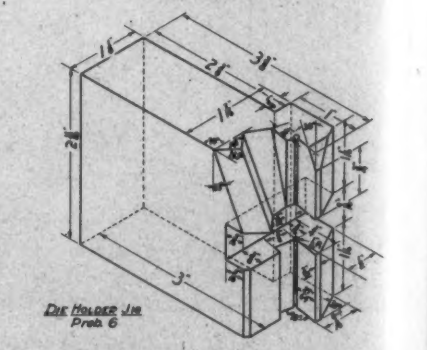


Prob. 4. *Bracket:* Draw three views in orthographic projection: front, top, and right side, and show conventional electric arc–welding symbols.









Prob. 5. *Intersection:* Draw development of part (1) and part (2) supplying own dimensions in addition to the 2½-in. diameter.

Prob. 6. *Die Holder Jig:* Draw three views in orthographic projection: front, top, and right side.

All of these problems contain important usable related information.

Conclusion. Drafting methods and techniques do change. As a result, we must attempt to keep up with industrial practice of today. Emphasis at the present is on blueprint reading, freehand sketching, and map making and interpretation. We should study and amplify the possibilities of pictorial representation as used in industrial production methods. Basically, any method of teaching drafting is the best method, if it efficiently produces the desired results with the least expenditure of labor.

General Lathe Training

G. RAYMOND TUTTLE*

As a teacher's check sheet to see in broad perspective the whole of the lathe training job, I have found the following notes of help.

These notes serve to emphasize the several elements of the teacher's job which are:

I. Safety
II. Related experiences
III. Operation of lathe
IV. Lubrication of lathe
V. What your student should be able to do on a lathe

They are being used in connection with war-production machine operation training, to give men a picture of the scope of lathe work and as a check list to select the jobs for further training.

Teacher's notes on general lathe training:

I. *Safety*

Some of your first training jobs are of a general nature. The first and continued interest in your work here is to "play safe." Safety involves many important trade practices such as:

1. Work with sleeves rolled up above the elbow.
2. Wear tight fitting clothing.
3. Make machine adjustments only when the machine is at rest.
4. Wear goggles when grinding.
5. Keep hands and clothing away from moving parts.

In short, work with care and respect for the machine you are running in order to avoid harm to yourself and damage to the machine.

II. *Related experiences*

1. To read a scale to 16th, 32nds, or 64ths.
2. To lay out the center of round stock.
3. To use a drill press and twist drill.
4. To use outside calipers.
5. To use a tap or die at a bench.
6. To use a combination drill and countersink.
7. To read the micrometer.

Check the items of safety and of general practices and when you have learned them all, hand in this sheet to the toolroom boy.

III. *Operations of the lathe*

A. *Drive feeds and speeds:*

Individual drive lathes are equipped with a switch for starting the motor and a clutch to connect the motor to the lathe. Some lathes have a *reversing and forward* switch in one switch box. Remote control switches have *start* and *stop* buttons.

1. Cone pulleys
2. Back gears

Most lathes have several possible spindle speeds for convenience in turning work of various diameters. Large diameter work should turn slowly with the back gears *in*. Small diameter work should turn fast with the back gears *out*.

1. Run the lathe in all possible spindle speeds. Be sure the machine has stopped running before changing to the next speed.
2. Lathe feeds are changed by a gearbox, individual gears, and gears operated through levers. There is generally a plate showing a table of gear connections for each feed. Set the machine for five different feeds. Start and stop the lathe after each change.

B. *Headstock center*

3. Remove headstock center and sleeve.
4. Clean taper hole in spindle of headstock.
5. Clean headstock sleeve on outside and inside.
6. Replace sleeve.
7. Clean headstock soft tapered center and replace.
8. Check the true running of headstock center.

If chips or dirt get on any of the foregoing surfaces, the center runs out of true.

C. *Tailstock center*

9. Remove tailstock center by moving tailstock spindle as far as possible to right.
10. Clean tapered spindle hole.
11. Clean outside of tailstock hardened center.
12. Replace in spindle.
13. Find a tailstock half center and inspect it. The purpose of a half center is to allow the tool to face the right end of the work.

D. *Longitudinal and cross-feed*

14. Turn on and off the longitudinal (lengthwise) feed.
15. Turn on and off the cross-feed (where there is such a feed).
16. Set the compound rest at 30 deg. beyond the parallel position.
17. Set the compound rest at 30 deg. from the straight across position.
18. Reverse the lathe feed at the headstock spindle.
19. Reverse the lathe feed by lever on apron.
20. Engage half nuts in lead screw for threading.

E. *More difficult operations*

21. Set tailstock (by hand if possible) 3/16 in. beyond center.
22. Set tailstock (by hand if possible) 3/16 in. toward operator from center.
23. Set gears for threading 4 threads per in.
24. Set gears for threading 28 threads per in.
25. Set lathe tool bit in toolholder and tool point at center height.
26. Grind a practice tool bit.
27. Clamp tailstock to bed of lathe.
28. Clamp tailstock spindle to tailstock.
29. Remove faceplate from headstock spindle.
30. Check the number of the lathe with faceplate, headstock, sleeve, and chuck. All should be the same.
31. Screw chuck on to headstock spindle.
32. True up a piece of 1¼-in. diameter stock in chuck.
33. How many turns of the cross-feed screw move the tool post 1 in.?
34. How many turns of the compound rest screw moves the tool post 1 in.?
35. What is the meaning of one graduation on the cross-feed dial?
36. What is the meaning of one graduation on the compound rest dial?
37. One graduation movement of the cross-feed would reduce the diameter how much?
38. One graduation movement of the compound rest would reduce the diameter how much?
39. Put lathe in condition with both centers in and tailstock straight.
40. Hand this sheet in to the instructor's desk when work is completed.

IV. *Lubrication of lathe*

1. Headstock spindle
2. Tailstock spindle
3. Change gears

*Lansing, Mich.

4. Back gear spindle
5. Ways of the bed
6. Feed rod, both ends
7. Lead screw both ends
8. Carriage cross slide
9. Compound rest slide
10. Apron parts

V. *What you should be able to do on the lathe*

Your objectives in working on the lathe are:

1. To obtain experience in operating the machine.
2. To be able to measure accurately.
3. To work within the limits of accuracy set down.
4. To perform a sample of each kind of lathe work you are likely to meet on the job.

Check off the kinds of work as you do them.

1. Straight turning on centers to a diameter
2. Read scale
3. Removing taper from the lathe
4. Read micrometer
5. Facing end of stock with use of half centers
6. Facing end of stock to length in chuck
7. File and polish
8. Turn to square and round cornered shoulders
9. Turning soft headstock centers
10. Knurling
11. Filing rounds
12. Turn tapers
13. Grinding tool bits for: roughing, facing, radius, cutoff, threading
14. Threading
15. Facing in chuck
16. Spotting center of stock in chuck
17. Drilling in chuck
18. Boring in chuck
19. Angle turning with compound rest
20. Some shop mathematics on: tapers, threading, tapping.

A PEDESTRIAN'S CODE

1. I will remember that this is the motor age.
2. Before stepping off the sidewalk I will take in all elements of the situation involving my walk over the intersection.
3. I will be guided by the traffic-light regulations just as the automobile driver is.
4. I will do my street crossing at intersections only.
5. I will keep a sharp eye in all directions while crossing.
6. I will urge all children to keep off the motor lanes.
7. On highways I will walk on the left edge of the road and will not interfere with auto traffic.
8. I will not step out suddenly from behind a car, or other object that obstructs the driver's view, into the path of traffic.
9. Instead of running across an intersection I will wait until it is safe to walk across.
10. I will remember that cars moving backward even a few feet are the cause of frequent accidents to the pedestrian.

— *Milwaukee Safety Commission*

Auto Mechanics and Auto Safety

O. H. SCHAEFER*

This course of study is an introductory course to auto mechanics and automobile safety. It was designed with the knowledge that in the average high school of approximately 300 to 500 students, equipment, room, and finances are not adequate to training expert drivers or expert mechanics. However, there is a growing demand that the motoring public of America which includes, for all practical purposes, everyone who lives at the present time be educated to observe safety if we are going to stop the slaughter of human lives by the motoring public.

To reach this goal, we must have some ideas of the conditions which have to be met on the road and what is resulting from these conditions. The present conditions can be remedied only by teaching the fundamental mechanical principles of the machine that causes the accidents, along with the problems of safety.

If the driver does not understand what makes the machine run or what takes place when it operates under abnormal conditions, how is he going to know how to handle the machine to prevent an accident, and also how is he going to bring the machine back to normal operating conditions?

With the foregoing idea in mind, the following course of study has been set up. The outline is written for a nine weeks' course of five one-hour periods per week, or a total of forty-five class hours; or for an eighteen weeks' course of five one-hour periods per week, or a total of ninety class hours. When the course is taught as a semester subject, the material should be covered more thoroughly in the discussion periods, and more time should be devoted to detailed adjustments, and more thorough work on cars brought into the shop.

Unit	Time Allotment in Class Periods			
	9-wk. Course		18-wk. Course	
Safety	Class	Shop	Class	Shop
Historical background	1		2	
Economic importance of automobile	1		2	
How the automobile runs	1		2	
Operating an automobile	2		4	
Keeping automobiles in safe running condition	1		2	
Physical condition of the driver	1		2	
The highway	2		4	
The pedestrian	1		2	
Traffic laws	2		4	
Causes of accidents	2		4	
Responsibility of the driver	1		2	
Society and the automobile; review	1		2	
General discussion	1		2	
Examination	1		2	
Mechanics				
The engine	1	2	2	4
Clutches	1/2	1	1	2
Transmission	1/2	1	1	2
Universal joints	1/3	1/2	1/2	1
Rear axles and differential	2/3	2½	1½	5
Front axles	1	1	2	2
Steering gear	1/3	1/2	1/2	1/2
Brakes	1/3	1½	1	3
Fuel system	1/3	1	1/2	2½
Cooling system		1/3	1/3	1/2
Springs and frame	1/2	1/3	1/3	1
Body and fenders		1/3	1/3	1/2
Ignition	1/2	2	1	4
Generator	1/2	1½	1	3
Starter	1/2	1	1	2
Lights	1/2	1	1	2
Lubrication	1	1	2	2

Time allotment

The shopwork is intended to be carried out by obtaining, from a local garage, some comparatively late model of a car that has been damaged so that it is beyond repairs. This machine is to be cleaned up and placed in the shop for the purpose of demonstrating to the class the principles of the machine. The class should be allowed to take the machine apart and to be reassembled as the parts are being studied. If the shop and equipment will permit, boys should be allowed to bring cars into the shop and do repair work under the instructor's supervision.

Two days a week should be spent in shopwork, a third day devoted to class discussions and to further information about the mechanical parts of an automobile.

The two days remaining of the week should be devoted to the discussion of automobile safety. The problems of safety should continually be related to the shopwork, not meaning, necessarily, that related units be taught at the same time, but that reference should be made to the automobile as the principles of safety are studied. The safety course should be conducted through the questions and problems of the student as much as possible.

*High School, Sac City, Iowa.

Reading material should be assigned to the extent that it will impress upon the pupil the problem of safety with which he is confronted.

Such a course, as outlined, can be carried on with a minimum of equipment. However, if sufficient equipment can be obtained, repair work should by all means be carried out. Much material for discussion can be had for the asking. Out-of-date shop manuals, sales literature, state publications, safety pamphlets, put out by the insurance companies and motor clubs are relatively easy to obtain.

Outline of Instruction

General Aims:

1. To reduce traffic accidents
2. To prepare youth to cope with the traffic program
3. To present the basic principles of science as applied to the automobile
4. To provide an opportunity to do mechanical work
5. To present the importance of safety in relation to the automobile and society

Specific Aims or Objectives:

1. To encourage safe driving habits
2. To develop safety consciousness
3. To create interest in science
4. To inculcate respect for labor, skill, and honest effort, through knowledge about safety and auto mechanics
5. To teach the principles which underlie the successful operation of the automobile
6. To teach the elements of the automobile — their function, maintenance, and operation
7. To develop an appreciation of the mechanical parts of an automobile and how they should be used

Time Allotment

Total length of course — 9 weeks or 18 weeks
Class period — 60-minute period, 5 days a week
Time devoted to safety — 2 days per week, 18 or 36 days total
Time devoted to shopwork — 2 days per week, 18 or 36 days total
Time devoted to mechanics discussion — 1 day per week, 9 or 18 days total

Units in Auto Safety

Unit I. Historical Background

Source Material: See items 2 and 23;[1] also encyclopedias.

1. Invention of the wheel
2. Invention of gasoline engines
3. Extraction of gasoline
4. First automobile
5. Development of automobile
6. Development of devices on cars

Unit II. Economic Importance

Source Material: See items 2 and 23.[1]

1. Changing of our family and home life
2. Business and pleasure
3. Automobile in relation to city and country dwellers
4. Bus and truck transportation
5. Economic importance

Unit III. How the Automobile Runs

Source Material: See items 6 and 13.[1]
An automobile engine.
Shop manuals.

1. Origin and development of power
2. Tracing the following in an engine
   a) Air into cylinder
   b) Gas into cylinder
   c) Strokes of the piston
   d) Ignition system
   e) Transfer of power from gas to energy
   f) The transmission and clutch
   g) The differential
3. Driving and influence on the automobile
   a) Gas consumption
   b) Engine wear
   c) Cost of speeding

[1]References are to numbered items in bibliography at end of this article.

[1]References are to numbered items in bibliography at end of this article.

Safety Units

1. Historical background
2. Economic importance of the automobile
3. How the automobile runs
4. Operating an automobile
5. Keeping automobiles in safe running condition
6. Physical condition of the driver
7. The highway
8. The pedestrian
9. Traffic laws
10. Causes of accidents
11. Responsibility of the driver
12. Society and automobiles; review

Units in Mechanics

1. The engine
2. Clutch
3. Transmission
4. Universal joint
5. Rear axles and differential
6. Front axle
7. Steering gear
8. Brakes
9. Fuel system
10. Cooling system
11. Springs and frame
12. Body and fenders
13. Ignition
    a) Generator
    b) Starter
    c) Lights
14. Lubrication

Unit I. The Engine

1. Theory of gasoline engine
   a) Effects of explosion
      1) Gas, vapor, and air
      2) Expansion in the cylinders
   b) Valves and cams
      1) Reduction from crankshaft to camshaft
   c) Carburetor
   d) Spark plug
2. Four-stroke-cycle engine
   a) Intake
   b) Compression
   c) Power
   d) Exhaust
   e) Crankshaft
   f) Flywheel

Unit II. Clutch

1. Purpose and position
2. Kinds
   a) Single plate
   b) Cone
   c) Multiple-disk clutch
3. Construction

Unit III. The Transmission

1. Principle of gears
   a) Low
   b) Second
   c) High
   d) Reverse
2. Relation of gears to power and speed
3. Overdrive
4. Freewheeling

Unit IV. Universal Joint

1. Purpose and location
2. Principle
3. Construction

Unit V. Rear Axles and Differentials

1. Purpose of differential
2. Construction of differential
3. Construction of rear axles
   a) Full floating
   b) Three-fourths floating
   c) Semifloating

Unit VI. Front Axle

1. Types
   a) I beam
   b) Tubular
   c) Knee action
2. Adjustment
   a) Toe-in
   b) Camber
   c) Caster

Unit VII. Steering Gear

1. Construction
   a) Screw and nut
   b) Worm gear
2. Adjustment

Unit VIII. Brakes

1. Principle of friction
2. Types
   a) Hydraulic
   b) Lockheed
   c) Bendix
   d) Huck
   e) Ford
   f) Mechanical
3. Adjustment
4. Wheel mounting

Unit IX. Fuel System

1. Construction of carburetor
2. Fuel pump
3. Types of carburetors
4. Throttle and choke

Unit X. Cooling System

1. Pumps
2. Thermostat
   a) Thermo-couple expansion
   b) Purpose
3. Radiator tube
   a) Round tube
   b) Honeycomb or hexagonal

Unit XI. Springs and Frame

1. Types of frames
   a) Y construction
   b) Y-K construction
   c) Box
   d) Channel
2. Springs
   a) Semielliptical
   b) Coil springs
   c) Transverse
   d) Cantilever or ¼ elliptic
3. Care of springs

Unit XII. Body and Fenders

1. Care of finish
2. Streamlining
3. Construction

Unit XIII. Ignition

1. Starter
2. Wattage
3. Condenser
4. Distributor
5. Lights
6. Battery
   a) Construction
   b) Principle
   c) Care of battery
7. Generator

Unit XIV. Lubrication

1. Importance
2. Kinds
   a) Splash
   b) Pump
   c) High pressure

Unit IV. Operating a Car

Source Material: See items 3, 5, 13, and 19.[1]

1. Habits of the driver
   a) Attention must be learned
   b) Distractions cause many accidents
   c) Habits make driving easy or difficult
2. Margin of safety
   a) Know the other driver
   b) Give the other driver room
   c) Stopping distance required
   d) Politeness to fellow drivers
3. Liquor
   a) Effects in body
   b) How much may be taken (none)
4. Carbon monoxide as a factor of safety
   a) When dangerous
   b) Prevention of monoxide poisoning
5. Pedestrians are a hazard
   a) Right of way over cars
   b) Rules for pedestrians
   c) Limitations of pedestrians
   d) Action of pedestrians and accidents
6. Children not conscious of danger
   a) Playing in street
   b) Going to and from school
7. Turns on the highway and traffic
   a) Force caused on curves
   b) Dangers on curves
   c) How to read road signs
   d) Turning street corners
   e) Hand signals
8. Overtaking and passing
9. Night driving
   a) Eyes at night
   b) Speed at night
10. Bad weather
    a) Ice, (b) rain, (c) fog, (d) wind

Unit V. Keeping Automobiles in Safe Running Condition

Source Material: See items 7, 10, and 22.[1]

1. Tires and tire wear
2. Defective brakes
   a) Stopping distance
   b) Road surface
   c) Reliability of brakes
3. Lights for protection
   a) Parking lights
   b) Taillight
   c) Stop light
   d) Spotlight
   e) Fog light
4. Body of automobile
   a) Construction for safety
   b) Glass influences safety
   c) Vision related to body construction

Unit VI. Physical Condition of the Driver

Source Material: See items 14, 21, and 24.[1] Also psychology books.

1. Vision of the driver
   a) Tunnel vision — straight ahead
   b) Color blindness — effects
   c) Distance judging — result of practice
   d) Field of vision as a safety factor
   e) Glare of headlights and sun
2. Reaction time of driver
3. Hearing of driver
4. The danger zone of fatigue
5. Emotional condition
   a) Nervousness
   b) Loss of temper
   c) Fear encourages accidents
   d) Indecision of actions
   e) Effects of emotional condition and how to correct them
6. Your attitude and your safety
7. Returns of kindness and courtesy

[1]References are to numbered items in bibliography at end of this article.

Unit VII. The Highway

Source Material: See items 3, 5, 8, 15, 17, and 20.[1]

1. Curves engineered with precision
   a) Markings of danger zones
   b) Dangers that may be met
   c) Centrifugal force and the automobile
2. Hills
   a) Dangers that may be met
   b) Actions during emergencies met on the hills
3. Intersections
   a) Approaching not always clear
   b) Entering highway and its danger
   c) Habits of stopping
4. Road surfaces
   a) Traction of various treads
   b) Weather effects and road surfaces
5. Signs used in city and country
   a) Shapes and meanings
   b) Obedience to signs
6. Roadway markings
   a) Center lines in two-way traffic
   b) Lane lines in multiple traffic highways
   c) Crosswalks for pedestrians
   d) Special movement lanes
   e) Special places of traffic rules
   f) Local parking rules
7. Speed on the highway
   a) Dangers of increased speed
   b) Relation to accidents
   c) Stopping distance under normal conditions
   d) Skidding characteristics
8. Passing on highways
   a) Distance necessary
   b) Precautions to consider

Unit VIII. Pedestrian

Source Material: See items 5, 17, and 23.[1]

1. Pedestrian responsibilities
   a) Obey traffic lights
   b) Follow lanes
   c) Position of pedestrians in regard to roadway
   d) Cross only at intersections
2. Driver and pedestrians
   a) Pedestrian has equal rights
   b) Pedestrian's direction is uncertain
   c) Getting off a bus or a streetcar
3. Confused pedestrian
   a) Dangers to traffic and to self
   b) Move slowly and surely

Unit IX. Traffic Laws

Source Material: See items 1, 7, 16, and 15.[1]

1. Pride in safe driving, rather than "daredevil"
   a) Laws regarding hand signals
2. More laws to be obeyed in cities
   a) Light signals and where to find them
   b) Lane traffic important
   c) Turning right and left in traffic
3. Country driving
   a) Speed to travel safely
   b) Conditions involved on leaving highway
4. Chauffeur's license
5. Driver's license laws

Unit X. Causes of Accidents

Source Material. See items 7 and 23.[1]

1. General accident situation in the United States
2. Prevention of accidents
3. Factors involved in accidents
   a) Failures on part of driver
      1) Inattention
      2) Speed
      3) Failure to judge distance correctly
      4) Recklessness or carelessness
   b) Contributing highway factors
      1) Poor vision at crossroads
      2) Insufficient road marking
      3) Unexpected obstacles on highway
   c) Mechanical defects of the automobile
      1) Bad brakes
      2) Faulty steering mechanism
      3) Blinding lights — yours and the other cars'
      4) Tire failures
      5) Faulty windshield
      6) No rear vision
   d) Pedestrian accidents
      1) When they occur
      2) Where they occur
      3) How they occur
   e) Railroad crossings
      1) Poor signals
      2) Lack of vision
      3) Warnings too late
      4) Obstructed view of tracks
4. Analysis of accidents by charts
   a) Severity
   b) Distribution by
      1) Age
      2) Driver and pedestrian
      3) Time
      4) Weather conditions
5. Accident records — how to keep and analyze
   a) Visit records
6. Improving safety records
   a) Insurance
   b) Claims

Unit XI. Responsibility of the Driver

Source Material: See items 14, 18, and 22.[1]

1. Powers given to driver
   a) Speed to handle
   b) "85 horsepower" in two hands
2. Financial aspect is important
3. Courtesy must be developed
4. Self-discipline necessary (1 police officer to 1000 autos)
5. Sportsmanship, a shortcut to safety
6. Safety consciousness required at all times

Unit XII. Society and Automobiles; Review

Source Material: See item 18.[1]

1. How the automobile has changed our lives
2. Improving the automobile by society
3. Controlling of automobile by society
4. Our highways — built before knowing how to use them
5. Traffic engineers at work
6. Regulations imposed by society
7. Observance and enforcement of common law
8. Influence of traffic behavior by officers

Annotated Bibliography

1. *Act V, Uniform Act Regulating Traffic on Highways,* United States Department of Agriculture, Bureau of Public Roads, 1939.

A uniform vehicle code prepared for the National Conference on State and Highway Safety.

2. *An Authoritative History of Transportation From 1400 B.C.,* Fisher Body Company, Detroit, 1934.

A history of transportation, starting with the very first means of transportation, explaining how our modern automobile evolved through the years.

[1]References are to numbered items in bibliography at end of this article.

[1]References are to numbered items in bibliography at end of this article.

3. Douglass, R. A., *Common Sense in Driving Your Car,* Longmans, Green, and Company, New York, 1930.

A discussion of the various phases of safe driving practices is given by the author. The material lacks organization, but sound principles are given for safety on the highway.

4. Drucker, Max, "A Course in Auto Mechanics," *Industrial Arts and Vocational Education,* Vol 23, p. 142 (April, 1934).

An outline of a course in auto mechanics, in high school, for 19 weeks. The study lists the various parts of an automobile to be studied each week.

5. Dull, C. E., *Safety First—and Last,* Henry Holt and Company, New York, 1938.

Elementary principles of driving are stressed by the author as he covers the fields of safety driving. About one half the book is devoted to safe driving, and the remainder to general safety. A bibliography, glossary, and questions are appended.

6. Explanatory Charts on "How the Engine Works," Customers Research, General Motors, Detroit.

These charts are helpful in showing how an engine works.

7. Fitzgerald, J. A., Hoffman, C. A., and Bayston, H. R., *Drive and Live,* Johnson Publishing Company, New York, 1937.

"Can America Control Driving?" is the topic of discussion. The author sets up the challenge of safety and then strives toward showing, first, how the driver must be educated; second, accidents, their causes and results; third, how to operate the car; fourth, the public and its relationship to the traffic problem. The book has a good bibliography, list of visual aids, examinations, and glossary.

8. Floherty, J. J., *Youth at the Wheel,* J. B. Lippincott Company, Philadelphia, 1937.

The author presents factors of safety in a well-illustrated and interesting fashion. The printing is very easy to read. The material is presented in a way that should be interesting to high school students. The author's purpose is to instill into young drivers the importance of safety consciousness.

9. Fraser, E. S., and James, R. B., *Motor Vehicles and Their Engines,* Van Nostrand Company, Inc., New York, 1930.

A number of the theoretical aspects of automobiles are discussed in minute detail.

10. "I Drive Safely," International Harvester Company, Chicago.

A helpful pamphlet on the art of safe driving.

11. Kuns, R. F., *Automotive Essentials,* The Bruce Publishing Company, Milwaukee, Wis., 1941.

The author deals with the fundamental parts of the automobile. The parts of an automobile are well described and illustrated.

12. Lacey, H. A., "Auto Mechanics," *Industrial Arts and Vocational Education,* Vol. 21, pp. 3–6 (January, 1932).

A course outlined to give the student a general knowledge of the automobile. The author lists the various jobs and gives aims, operations, and related information for each unit.

13. "Lest We Regret," Travelers' Insurance Company, Hartford, Conn.

A free booklet published for the purpose of presenting facts regarding automobile accidents. Many tables are given of accidents; statistics, such as types of accidents, time of accidents, and accidents in relation to age, are given.

14. "Live and Let Live," Travelers' Insurance Company, Hartford, Conn., 1936.

This is another pamphlet which aims to present facts of automobile accidents and to instill a feeling of safety consciousness in the reader.

15. *Model Traffic Ordinances,* United States Department of Agriculture, Bureau of Public Roads, 1936.

This pamphlet consists of three closely connected parts, namely, model traffic municipal ordinances, a model traffic administrative ordinance, and provisions of state laws which might well be included in the traffic ordinances. It gives a uniform vehicle code recommended for state legislation, as offered by the Fourth National Conference on State and Highway Safety in 1934.

16. Motor Vehicle Laws of Your Own State.

17. "Sportsmanlike Driving," Safety and Traffic Engineering Department, Chicago Motor Club, Chicago, Ill., 1935.

In this booklet, the topic and problem of safety are discussed. The driver, pedestrian, traffic rules, and driving facts are the main topics.

18. Sportsmanlike Driving Series, "Society's Responsibilities," American Automobile Association, Washington, D. C., 1940.

The relationship between society and the automobile is very well illustrated and presented in this booklet. The rapid development of the automobile and the way that society is coping with it gives rise to most of the topics. A good bibliography of available material is given.

19. "Traffic Safety Manual and Common Traffic Problems," Iowa Department of Public Instruction and Iowa Motor Vehicle Department, 1938.

The manual may best be described by the title as it contains problems of safety and traffic. The illustrations are very good and are helpful in studying the problems given.

20. "Uniform Traffic Control Devices for State and Highways," National Conference on State and Highway Safety, Washington, D. C. (September, 1937).

A study made by the American Association of State High Officials and the American Engineering Council, for the National Conference on State and Highway Safety. It is a step toward standardization of traffic control devices. The specifications and information given are considered as an American standard.

21. Waring, James, "Higher Education for Drivers," *Reader's Digest* (May, 1936), pp. 51–55.

22. "We Drivers," General Motors Research Corporation, Detroit.

This deals with the topic of driving on the highways.

23. Whitney, A. W. (ed.), *Man and the Motor Car,* Educational Series, Vol. X, National Bureau of Casualty and Surety Underwriters, New York, 1936.

The book gives a brief discussion of what makes an automobile run. The subject of safe driving is dealt with in detail. The material is not illustrated to the best possible advantage.

24. Wiggins, A. E., "Women Drivers," *Reader's Digest* (March, 1932), pp. 35–37.

Safety in the School Shop

SAMUEL F. HALL*

Accidents to pupils in the public schools caused a total absence of 2,160,000 pupil days during one year.

Accidents in the shop occur at various times. In one state, one accident to every three students took place in one year. The National Safety Council says, "The influence of the vocational shop and the gymnasium on the accident rate is indicated by the sudden jump in the rate from the sixth to the seventh grade, which rose from 1.5 to 3.5. Further advance to 4.7 in the tenth grade and 5.4 in the eleventh indicates an increase in exposure to accidents."

*High School, Clayton, Mo.

It has been found in various shops that October is the month of accidents, and, of course, various times of day are hazardous.

Where Accidents Happen

School buildings and grounds, 4.75 per cent; going to school, .75 per cent; home, 3.50 per cent; other places, 3.25 per cent. In the gymnasiums, 35 per cent; on halls and stairs, 20 per cent; shops, 14 per cent; classrooms, 13 per cent; other locations in the school, 18 per cent.

Parts of Body Affected

Head, 14.89 per cent; neck, .63 per cent; shoulders, .50 per cent; arms, 8.21 per cent; hands, 5.12 per cent; fingers, 3.32 per cent; body, 2.47 per cent; legs, 14.26 per cent; ankles, 36.25 per cent; feet, 2.33 per cent.

Assignment

1. How many more boys have accidents in the high school than in the sixth grade? .....

2. If our school year is 216 days, how many boys missed school last year because of accidents? .....

3. Which classes have the greatest amount of accidents? Could we prevent this? .....

4. Which part of the body gets the greatest knocks? .....

Specific Safe Practice in the Shop

1. Keep the tools off the floor.
2. Keep the aisles of the shop clean.
3. Place small pieces in the scrap box.
4. Return unused material to the storage.
5. Carry long pieces with the front end high.
6. Carry no nails in the mouth.
7. All files and chisels should have handles.
8. Hammers with damaged heads should not be used.
9. When using equipment, keep bolts and nuts tight.
10. When in doubt, have machine checked by the instructor.
11. Note machines for unusual sounds, and stop it if the reason for the sounds cannot be located.
12. Do not leave machine running when not in use.
13. Only one student should operate a machine at a time.
14. Help create a safety consciousness.
15. Do not talk while operating a machine.
16. Stand clear of machines.
17. Speed is not the first factor in the shop.

Assignment

1. Why does the last class in the day have to use more care in safety? .....
.....

2. Name some tools you have noted on the floor. .....
.....

3. What do we mean by good housekeeping? .....
.....

4. Do you think it wise to talk while operating a machine? .....

5. What do we mean when we say a machine can have harmony? .....
.....

6. Can we as a class provide for a safety program in our class? ..... In our school? .....

Student Managers in the Shop

General Information: Considerable leadership can be taken by the students in the shop. Often the responsibility for caring for various duties are handled by different boys.

Assignment

1. Make a list of the duties a class could oversee. .....
.....
.....

2. List here what a machine foreman could do. .....
.....
.....

Specific Information: Duties of the safety foreman.

1. Encourage the wearing of aprons, see that sleeves are rolled up, and that all ties are tucked in place.
2. Watch for open flames.
3. Encourage the use of goggles.
4. Watch for unusual noises.
5. Keep tools off the floor.
6. See that damaged tools are not used.
7. Inspect first-aid cabinet.
8. Care for minor cuts.
9. Discourage horseplay.
10. See that guards are used.
11. Watch for flying hot metal.
12. See that belt sticks are used.
13. See that work on the drill press is held firmly.
14. See that fellow students do not crowd the machines.
15. Report unsafe practices.
16. See that safety posters are in place.
17. .....
18. .....

(*To be continued*)

A Functional Vocational School Diploma

BENJAMIN J. NOVAK*

The reaction against huge, unwieldy pieces of "sheepskin," impressively inscribed in Latin and bedecked with imposing seals, set in a good many years ago. Many individuals, at the ebb of the first flush of achievement, remove such useless massive dust catchers from parlors and living rooms and relegate them to attics. These old-style documents now function, if they function at all, to bolster the precarious confidence of the afflicted as they while away apprehensive moments in the outer chambers of physicians and dentists.

An early modification was the introduction of 8- by 10-in. diplomas, bearing its information in English. The result was a saving of parchment, a smaller area exposed to the collection of dust, and a gain in legibility. A further developmental step was its removal from the wall, and placing it in a more or less substantial cover. The diploma could then very conveniently be placed in a corner of a drawer and forgotten.

At the Dobbins Vocational School, a very practical form of graduation certificate has come into use. No claim to originality is made for it, however.[1] The certificate is in book form with a stiff backed leather cover measuring 4¼ by 6½ in. Murrell Dobbins Vocational School is stamped in gold on the cover. The contents consist of a single sheet of parchment folded, and bound along the fold, forming 4 pages.

Page 1 indicates the name and location of the school, name of the graduate and his trade. Under the trade name is listed approximately six main units of the trade, and the number of hours of instruction the student has received in each unit. At the end of the list is recorded the number of hours of actual employment in the trade. At the bottom of the page the related subjects are named.

Pages 2 and 3 form a spread on which is reproduced a documentary certificate basically similar to the conventional diploma. The school district, student, trade, and date are indicated. It bears the signatures of the superintendent of schools and the principal.

Page 4 carries a detailed outline of the work covered in each unit of the trade. The information given here is fairly explicit.

This type of certificate has displayed definite advantages over the older types. Its portability permits graduates to carry it and present it for inspection by prospective employers. Employers, likewise, are developing the habit of asking for such certificates as credentials for students seeking employment.

Thus has the diploma been removed from the uselessness of wall, attic, and drawer and been pressed into an active service.

The next great task of humanity is not deliverance by the sword, but deliverance from the sword. — *David Lloyd George.*

There are no gains without pains. — *Benjamin Franklin.*

*Murrell Dobbins Vocational School, Philadelphia, Pa.

[1] The graduation certificate was designed and introduced to the Dobbins Vocational School by J. Norwood Baker, principal. He used as its general model the form already in use at the Washburne Trade School in Chicago, Ill.

Strength of Materials for High School Students

A. M. Youngquist*

A complete study of the strength of materials is properly a college engineering subject, but high school students in advanced machine drawing, architecture, and in the machine shop may well profit by a lesson or two on the relative strength and properties of the common materials — timber, cast iron, wrought iron, steel, and strong steel. High school students should have a speaking acquaintance with the terms — elastic limit, tension, compression, shear, torsion, allowable unit stress, and factor of safety as applied to strength of materials. They should have some idea as to the distribution for strength of the material in webs, beams, and standard shapes such as angles, I beams, and the like. They should know how to determine the diameter of a bolt for a given load, because calculations of this kind are well within their grasp and ability. It does not take long to present this material and the subject is definitely stimulating and interesting. The notes, tables, and sample problems should be made a part of the student's notebook, and the material reviewed and tests given as usually required for new subject matter.

A cursory inquiry among drawing and shop teachers shows that very little is given in high school industrial arts or in the vocational high schools on the strength of materials. To those who do touch on this subject in their teaching as well as to those who have not tried it the following approach may be interesting and helpful:

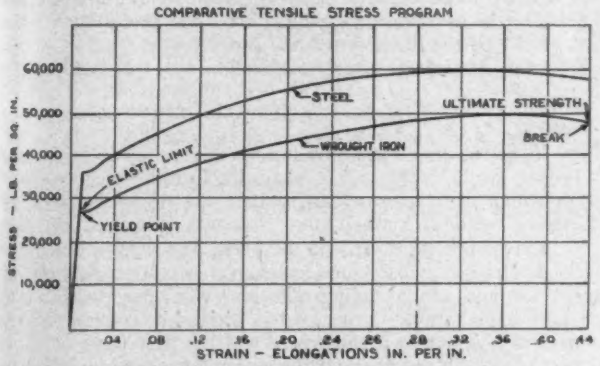


Fig. 1. Stress diagrams. Individual test pieces may deviate considerably from the curves shown

First, an explanation is given in simple terms of what is meant by tension, compression, shear, and torsion (or twist) as applied to materials. Example: A vertical bar with its upper end fastened and a load applied to its lower end is in tension, or in other words, the bar is subject to a tensile stress. The load tends to stretch or lengthen the bar, and if the bar is subjected to a gradually increasing tension the elongation is proportional to the load up to or until a certain limit, called the *elastic limit*. This is reached when the elongations increase in a faster ratio than the applied loads. When the unit stress (lb. per sq. in.) in a bar is not greater than the elastic limit, the bar returns to its original length when the load is removed. When the unit stress is greater than the elastic limit, the bar does not return to its original length and a *permanent set* remains. Thus, the elastic properties of a bar are injured when it is stressed beyond the elastic limit. Therefore, in designing a structure the bar size should be large enough so that the unit stress does not exceed the elastic limit. In fact, to be on the safe side, the engineer selects a bar to withstand a given load whose cross-sectional area is such that the allowable unit stress is about half that of the elastic limit of the material used. This margin of safety determines what is called a *factor of safety*. All of this can best be illustrated by a concrete example. When a wrought-iron bar one square inch in section area, and 100 inches long, is subjected to gradually increasing known tensile loads, the following conditions occur:

Wrought iron bar, 100 in. long, 1 sq. in. in cross section		
Load in pounds	Elongation in inches per inch	
5,000	.02	Allowable unit stress is about 1/2 of the elastic limit, and approximately 1/4 of the ultimate strength. This means that a factor of safety of 4 is used. The elongation is proportional to the load, and there is no permanent set when the load is removed.
10,000	.04	
15,000	.06	
20,000	.08	
25,000	.10	Permanent elongation or stretch. The material is injured but does not break.
30,000	.50	
40,000		
50,000	3.00	Bar ruptures or breaks — the ultimate tensile strength.

Table I

It will be noted that the *factor of safety* is usually given in terms of the *ultimate strength* and not of the elastic limit. Furthermore in practice the factor of safety used will vary with the nature of the applied load or stress.

The following table illustrates the average factors of safety used for different materials under different circumstances:

Material	*Steady Stress*	*Variable Stress*	*Shocks*
Timber	8	10	15
Cast iron	6	10	20
Wrought iron	4	6	10
Structural steel	4	6	10
Strong steel	5	8	15

Table II. Factor of safety

Fatigue in metals is an interesting phenomena and may be touched upon briefly. A bar may rupture because of *repeated* applications of a unit stress *less* than the ultimate strength of the material. For example, a wrought-iron bar subjected to a vast number of variable stresses may rupture at 25,000 or 35,000, instead of its normal ultimate strength of 50,000 lb. per sq. in. This condition is sometimes referred to as fatigue and as may be seen in the foregoing table, the design of an engine part subjected to variable stresses requires that a higher factor of safety be used than if the part were under a steady stress only. Material subject to sharp blows, impact, or shock require a still higher factor of safety. Loss of strength due to variable stress is, of course, greatest when the stress alternates from tension to compression and back again an enormous number of times such as that in reciprocating parts of an engine.

	Loads in pounds per sq. in.					
	Ultimate Strength				Elastic Limit in Tension	Ultimate Elongation Per Cent
Material	Tension	Compression	Shear	Torsion		
Timber	10,000	8,000	3,000	2,000	3,000	1.5
Cast Iron	20,000	90,000	18,000	30,000	6,000	0.3
Wrought Iron	50,000	50,000	40,000	40,000	25,000	30.0
Structural Steel	60,000	60,000	50,000	50,000	35,000	30.0
Strong Steel	100,000	100,000	80,000	90,000	50,000	15.0

Table III

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As a result of a great many tests the following approximate average values have been determined of the *elastic limit* and *ultimate strength* of the common materials used in engineering. The table shown was taken from *Mechanics of Materials*, by Merriman.

The term *strong steel* in the foregoing table is not a trade name and is used for instructional purposes only. The grades of strong steel are very numerous and range in tensile strength from 60,000 to 250,000 lb. per sq. in., as a result of special treatment and the introduction of other elements such as nickel, chrome, tungsten, manganese, etc., in their manufacture.

Interesting comparisons can be made from the table. For instance, the ultimate strength of cast iron under a compressive load is very high, but its tensile and shearing strength is comparatively low, whereas the strength of wrought iron and steel does not vary greatly under any conditions of stress.

The following values of ultimate strengths are taken from "Iron and Steel Specifications" prepared by the Society of Automotive Engineers.

Materials	Loads in lbs. per sq. in.				
	Ultimate Strengths			Elastic Limit	Ultimate Elongation Per Cent
	Tension	Compression	Torsion	Tension	
White Oak	13,000	8,000	1,000	5,000	
Gray Cast Iron	22,500	110,000	25,000		4
Wrought Iron	48,000	35,000	30,000	25,000	35
SAE 1010 Steel	60,000	40,000	45,000	35,000	40
SAE 2340 Steel	95,000	95,000	70,000	60,000	15-27

Table IV

Standard SAE tables contain a great number of special materials. However, the approximate average values in the foregoing table are satisfactory and less confusing to the beginning student.

The instructor should explain the use of testing machines and how sample bars are taken for tests. Pictures of testing machines and test bars will be helpful.

Now to solve a simple problem: required — a wrought iron bolt to properly sustain a given steady load of 15,625 lb. Let P = load in lb., S = allowable unit stress in lb. per sq. in., and A = cross-section area of the bolt in sq. in. Then $A = \frac{P}{S}$; therefore $A = \frac{15{,}625}{12{,}500}$, S being the allowable unit stress derived from the ultimate strength of wrought iron, 50,000 lb. per sq. in., with a factor of safety of 4, or a unit stress of 12,500 lb. per sq. in. The area of the bolt cross section is, therefore, 1¼ sq. in. Reference to a diameter-area table shows that a bolt diameter of approximately 1¼ in. will be required. However, another factor must be considered as the strength of a threaded bolt in tension is no greater than that of the cross-section area at the root of the thread. A bolt, therefore, must be selected whose thread root area is 1¼ sq. in. The diameter of the bolt (national coarse threads), therefore, will be 1 7/16 in. Another factor may also affect the picture. If the bolt happens to be for holding-down purposes and the nut is tightened to say 1600-lb. pressure, an initial stress is set up in the bolt due to tightening and this must be added to the original specified load of 15,625 lb. which, following the procedure above, will require a bolt with a diameter of 1⅝ in. These modifying conditions illustrate how an engineer or designing draftsman must analyze and weigh all the factors of his problem.

Here it is well to have the students solve a problem themselves with new conditions, say for a steel bolt, 60,000 ultimate strength, to sustain a steady load of 10,000 lb., disregarding the added stress of tightening the nut. Other simple load problems also may be given.

Likewise a shear problem can be illustrated thus: required — the diameter of a steel pin (ultimate shearing strength 50,000 lb., per sq. in.), subjected to a steady shearing stress of say 6000 lb. If a factor of safety of 5 is used, the allowable unit stress will be 10,000 lb. per sq. in. Then A = P ÷ S, or A = 6,000 ÷ 10,000 = 0.6 sq. in., or a pin diameter of ⅞ in. is required for conditions of single shear as illustrated in Figure 2. For double shear as illustrated in Figure 3, there are two surfaces, C and D, over which the shearing stress is distributed, and each of them must have an area of one half the total shearing area A, or 0.3 sq. in., which will require a pin diameter of ⅝ in.

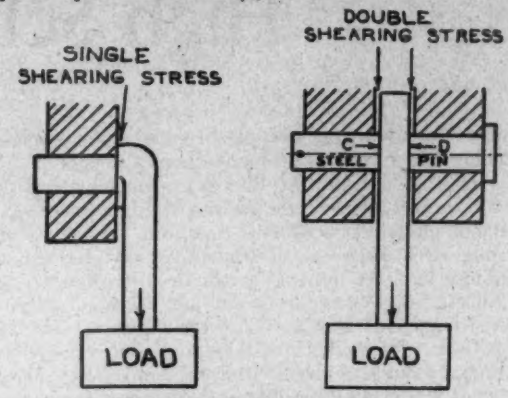

Fig. 2. Shows single-shearing stress, and
Fig. 3. Double-shearing stress

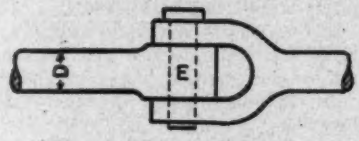

Fig. 4. Connecting rod

Suppose the case was that of a connecting rod pin, E, Figure 4, subject to sudden varying shearing stresses (double shear). Such a case would call for a safety factor of 12. For the same load and ultimate shearing strength as in the preceding problem, what would be the diameter of the pin? Answer, 1 in.

The rod, D (alternating compression and tension) will be $A = \frac{6000}{60{,}000 \div 12} = 1.2$ sq. in., or 1¼ in. diameter.

The *distribution* or form of materials to give maximum strength in beams, arms, webs, etc., is an important consideration in design which can be presented so that the principles are easily understood without mathematics. Students will tell you that a 2- by 8-in. plank supported at the ends, and with a load at the center, is stronger if used on edge than if it is used flat, but they cannot tell you why. Leading questions will bring forth a fairly adequate explanation. If the load is increased so that the beam bends and is about to break where will the first signs of rupture occur? Answer, in the fibers at the extreme lower edge. What kind of stress occurs there? Answer, tension. What kind of stress occurs at the extreme upper edge? Answer, compression. What stress occurs on the center line, N-A? Answer, none. This line at the center where no stress occurs is called the *neutral axis*.

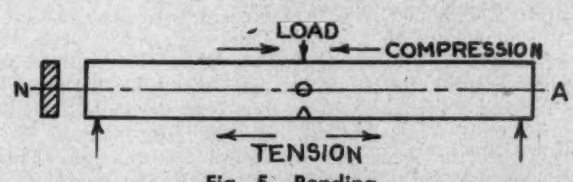

Fig. 5. Bending

If the fibers along the lower edge are strong enough so that they will not pull apart in tension, will the beam break? Answer, No. If a small hole, say 1 in., is bored at the center of the beam on the line N-A will the beam be weakened much? Answer, No. Why? Because there is no stress there. If a small notch is cut across the lower edge 1 in. deep, will it weaken the beam? Yes, considerably. From the foregoing may be deduced the principle that horizontal stresses are directly proportional to their distances from the neutral axis. In other words, for maximum strength, material in a beam should be *concentrated* as far from the neutral

axis as is practical. This principle has led to the adoption of standard economical shapes such as I beams. An I beam is many times stronger than a solid round or square beam of the same total cross-sectional area or weight per foot because there is a concentration of material at a considerable distance from the neutral axis. The question may be raised, "Why not make the vertical web in an I beam almost paper thin so as to concentrate still more material in the upper and lower *flanges?* Answer, the beam would collapse sideways, or the web itself bend or rupture. There is a limit beyond which it is impractical to go in distributing material for strength.

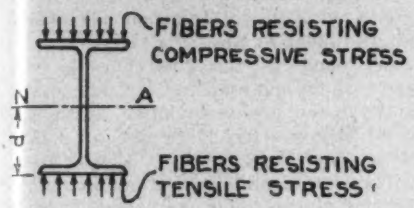

Fig. 6

Fig. 8. A bulb angle

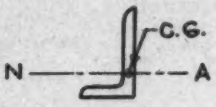

Fig. 7

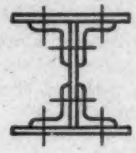
Fig. 9. A built-up beam

The neutral axis for unsymmetrical shapes such as an angle iron occurs at the center of gravity of its cross section. See Figure 7. Angle irons, T bars, Z bars, H sections, etc., are all economical shapes adopted for various purposes. Another example: Why are bulb angles effective stiffeners for light bulkheads? Answer, the flange is riveted to the bulkhead plates and the bulb on the standing flange gives strength because of the added material concentrated at the extreme edge of the angle.

Example: Why is a pipe which contains the same amount of iron (or the same weight per foot) stronger than a solid bar? Answer, material is concentrated at a considerable distance from the neutral axis. Other examples can be given, such as built-up beams.

Ask the students for examples of machine parts designed for strength with a corresponding saving of material and weight. (Webs, T sections, H sections in gear arms, connecting rods, etc.)

Check, question, and repeat so as to be sure that the learner really learns and understands the material presented.

The student should preserve the following definitions in his notebook:

Stress in material occurs when a force or load is applied.

Unit Stress is the stress per unit area of cross section.

$$S = \frac{P \text{ (load in lb.)}}{A \text{ (area in sq. in.)}}$$

Example: To find the unit stress of a bar 2 in. by 2 in. in cross section with a load of 50,000 lb. in tension.

$$S = \frac{P}{A} = \frac{50{,}000}{4 \text{ sq. in.}} = 12{,}500 \text{ lb. per sq. in.}$$

Tension occurs when a load is applied tending to stretch or pull a piece apart. A suspended rope or bar supporting a weight is in tension.

Compression occurs when a load is applied tending to press together, shorten, or crush a piece as in a column supporting a weight.

Shear occurs when a load is applied to a bar close to and in opposite direction to its support tending to cut or shear the piece.

Torsion occurs when a load is applied tending to twist a bar or shaft. Torsion is a form of shear.

Elastic Limit is the highest stress from which a piece will return to its original length when the load is removed. Beyond this point a permanent stretch or elongation occurs.

Yield Point is the stress at which elongation increases without any increase in load. See stress curves, shown in Figure 1.

Ultimate Strength is the highest stress a material will withstand without breaking.

Factor of Safety is the ratio between the ultimate strength and the working unit stress. Factor of Safety $= \frac{\text{Ultimate Strength}}{\text{working unit stress}}$.

Fatigue — failure of a material that occurs at less than its normal ultimate strength due to stresses repeated an enormous number of times.

The student also should add the following foundamental principles of engineering design to his notebook:

1. A structure must safely withstand all the stresses to which it may be subjected.

2. A structure should be designed so that it may be built and maintained at the lowest possible cost. A saving in cost usually results in a saving in weight which is often an important factor in design. Hence, a knowledge of the strength of materials is necessary in engineering design.

This simple introduction to the study of strength of materials has been successfully used in high school, night school and defense drafting classes. The material may be expanded, and various applications explained more fully by means of pictures and blackboard sketches.

Manipulative and Nonmanipulative Time Elements

ARTHUR A. DICK*

Industry makes extensive use of time studies. Why not make use of time studies in the school shops?

The proportions in manipulative and nonmanipulative time, in the following study, were arrived at through job analysis techniques and time-element computations.[1] The findings apply to the average junior high school general shop organized with five activities: bench metal, sheet metal, woodwork, electricity, and mechanical drawing. Therefore, the values should be considered as central tendencies.

In time studies, it is important to define and clarify terminology. Let us consider the following terms as they apply to this study.

Related subject matter. Related subject matter is synonymous with the terms related subjects, consumer knowledge, and general industrial processes. Related information and technical information are subheadings under related subject matter. Related subject matter may include industrial-arts appreciation, social and

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[1]Dick, Arthur A., "A Dual Organization of General Shop With Related Subjects," unpublished thesis, University of Maryland, 1940.

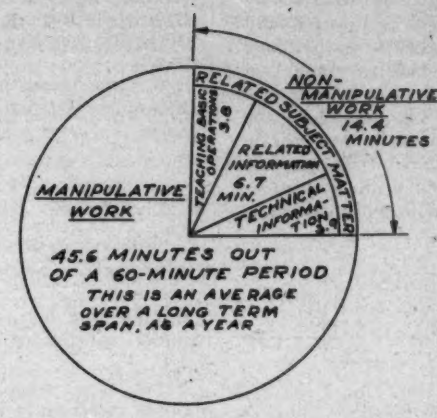
economic problems of industry, a study of the materials of construction, occupations study for guidance, and some mathematics and science.

Related information. Related information is industrial information which the student should know, but which is not essential in the making of a project.

Technical information. Technical information is knowledge which is necessary for the student to know in the making and utilization of a project.

Basic operations. Basic operations are fundamental operations which may be repeated a number of times. They are selected for teaching purposes in order to avoid needless repetition in their presentation. Operations are a series of manipulations used in the construction of a project, or part of a project.

Manipulative work. Manipulative work is the actual handling of tools, machines, and the performing of operations.



Circle graph representing a 60-minute class period showing the average manipulative and nonmanipulative time elements for the average general shop at the junior high school level

Nonmanipulative work. Nonmanipulative work is thought of as mental work consisting of related subject matter and the subheadings of related information and technical information.

The following questions have often been asked. How much time should be used in a period for related subject matter? How much time should be used for related information? How much time should be taken for technical information? What proportion of the total time should be used for manipulative work?

According to the conditions of this study, about one fourth of the time should be used for nonmanipulative work, and about three quarters of the time for manipulative work.

There are definite indications that time-element studies offer real possibilities in the school shop, and will assist the instructor to solve troublesome problems, and make his work much more effective.

A Survey of the Production Problem in the Junior High School Print Shops

FRANK DI GIACOMO*

This study of the printing production problem in the junior high schools was undertaken with a view toward eliminating some of the evils of production and establishing more uniform regulations concerning production, with the ultimate objective of improving printing education.

The objective methods used in obtaining the information contained in this study include a questionnaire sent to printing instructors, personal conferences with instructors, analyses of their experiences, and a study of those schools in which production is not a problem. Every effort was made to be scientific in the analysis of the data collected and impartial in its interpretations.

Aims of printing in the junior high schools:

1. To afford an opportunity for boys to explore one of the major industries in the United States; and to discover interests and aptitudes for guidance purposes.
2. To develop intelligent consumer appreciation of good printing.
3. To provide adequate opportunity for concrete applications of arithmetic, art, English, and science, through correlation with those subjects.
4. To develop cultural interests in printing; and to stimulate leisure-time hobbies involving printing activities.

Definition of production:

1. All jobs not definitely prescribed in the course of study followed in the junior high schools.
2. Any printing job not originating within the school print shop, by the students.
3. Any job containing excessively repetitive processes which after a certain point decrease in educational value.

Three classes of production:

1. Approved production, when set in linotype composition outside:
   - *a*) Printing for school musicales and entertainments.
   - *b*) Commencement programs.
   - *c*) School paper.
2. Acceptable production, when instructor feels it will add to the educational progress of his students:
   - *a*) P.T.A. printed forms.
   - *b*) G.O. club cards; posters designed by the students.
3. Objectionable production:
   - *a*) Rule forms, which are obviously beyond the students' capacity.
   - *b*) Forms requiring long press runs so that work becomes repetitive and tiresome.
   - *c*) Jobs which only the instructor has the knowledge and skill to produce.

Control of production:

1. Cooperation between the instructor of printing and the principal of the school is necessary.
2. The instructor must show evidence to his superior that he has a regular course of instruction which is serving a positive function in the education of the youth in the school.
3. Principals should seek in their school-shop activities the maximum educational values and not think that the school shop has been organized for production purposes only.
4. A mutual understanding of the functions and purpose of the school print shop will aid greatly in formulating regulations for the control of production printing and in directing the work to fit into the regular course of instruction.

Advantages of controlled production:

1. Increases pupil incentive by learning with real jobs.
2. Offers a variety of work, when properly selected.
3. Develops consumer knowledge of printing, selecting, and ordering materials.
4. Makes the print shop an important center of the school.
5. Offers wider contacts and learning possibilities for the pupil.
6. Increases the amount of material available for pupil instruction.
7. Advertises the work of the school print shop.

Disadvantages of uncontrolled production:

1. Prevents the achievement of the aims set up for graphic arts education.
2. Interferes with the continuity of a regular course of instruction.
3. Exploits the pupils, thus condoning the evils of child labor against which the nation has struggled for years.
4. Exploits the teacher who must often

(Continued on page 135)

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WHAT ARE THE FORMS OF POTTERY VESSELS?

Vessels are commonly made with foot, body, and neck, with appropriate lip, handle, spout, or lid, as use may indicate. The body is the principal part whose form usually dominates the remainder of the piece.

Naturalistic

Conventional

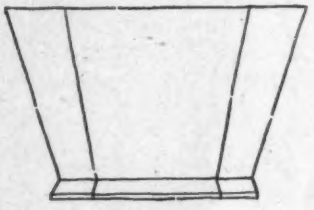
Squirrel Bottle c.1826
Shenandoah Pottery

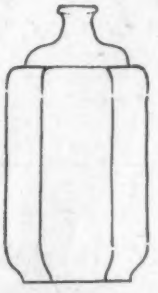
K'ang-hsi Vase
Pear-shaped (Pyriform)

Porcelain Vase
Baluster-form
with Trumpet Neck

Geometric

Flat-sided forms of 3, 4, or more sides in truncated pyramidal shapes for slab and hand-built construction. These right regular figures may be inverted.





Quadrilateral
Baluster form

Pentagonal Bowl

Hexagonal Bottle
with short pyriform top

The feet and neck of geometrical-shaped vessels usually follow the same figure as that of the body, although transitions to other figures may be made, as in the *sake* bottle at the right. Conventional or naturalistic handles and other appendages may be used with these geometric figures.

Plate 32. Design course by Burl N. Osburn, director of industrial arts, State Teachers College, Millersville, Pa.

POTTERY FORMS (Continued)

The potter's wheel (with its machine counterpart the jigger) has greatly influenced pottery forms which are, in consequence, usually circular in section. In profile the more complex geometric forms thrown on the wheel assume the general shape of the sphere, spheroid, cylinder, cone (ellipsoid, paraboloid, hyperboloid) or ovoid, with combinations of these, as well as baluster and pyriform.

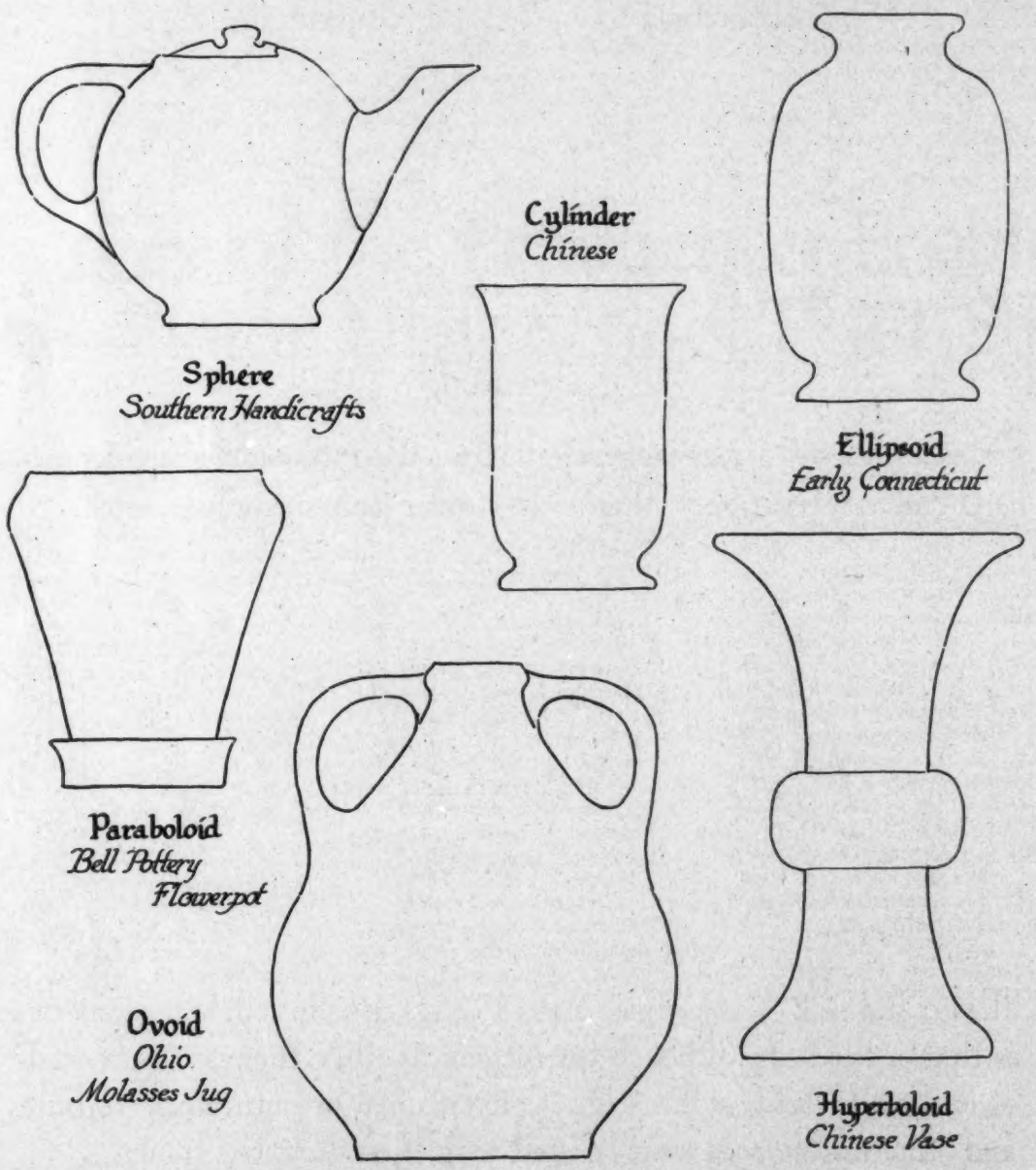


Plate 33. Continuation of design course by Burl N. Osburn, director of industrial arts, State Teachers College, Millersville, Pa.

PLATE 18 STYLIZED ANIMALS

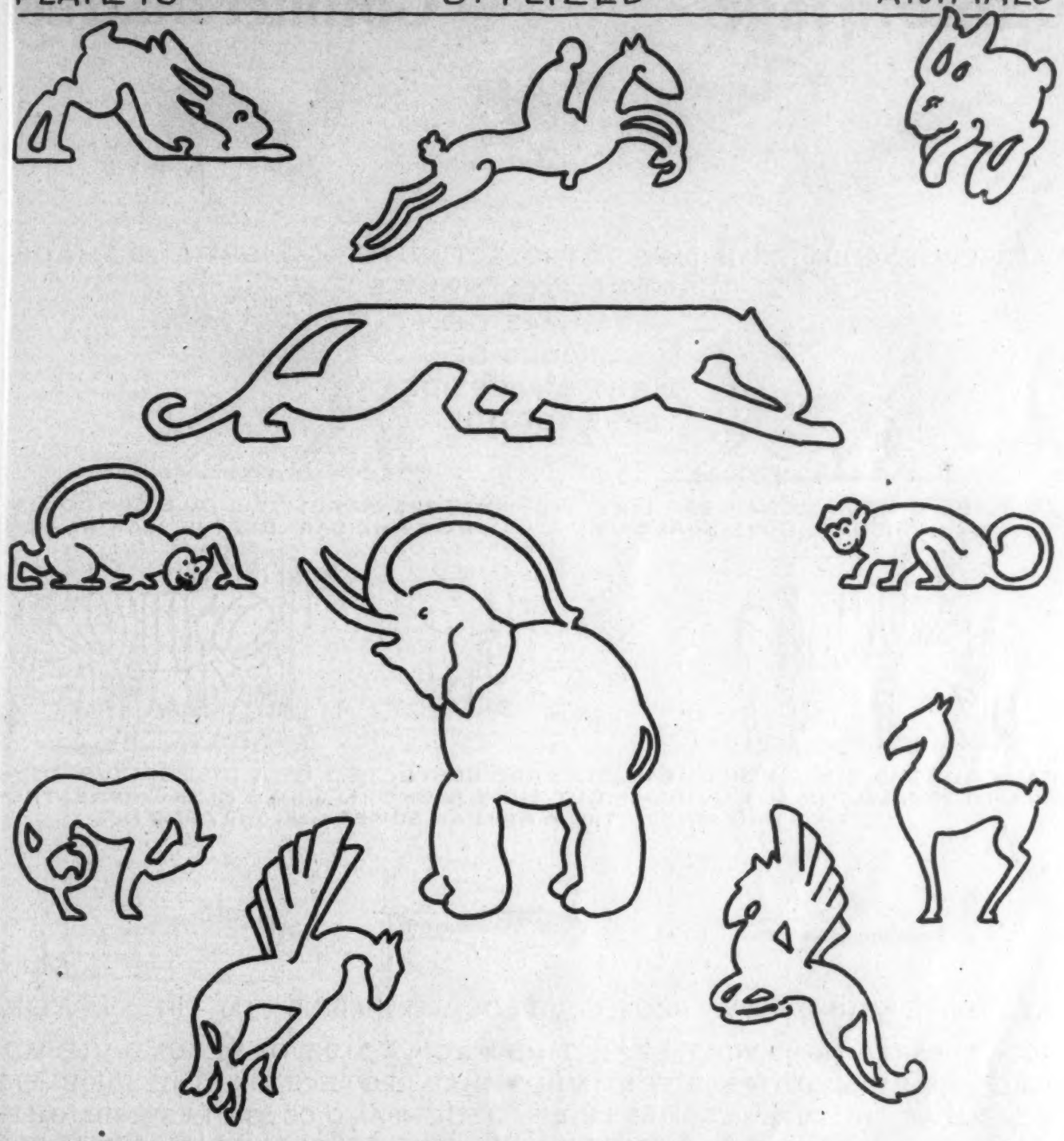
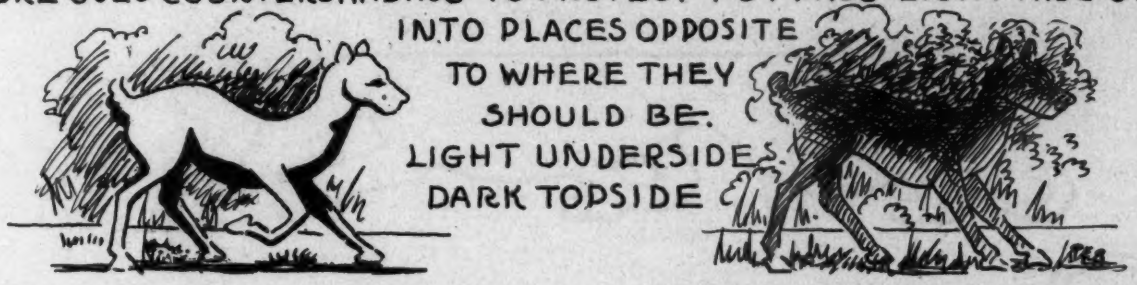


Plate 18. Creative design course by Richard E. Bailey, chairman, art department, Central High School, Providence, R. I.

Camouflage

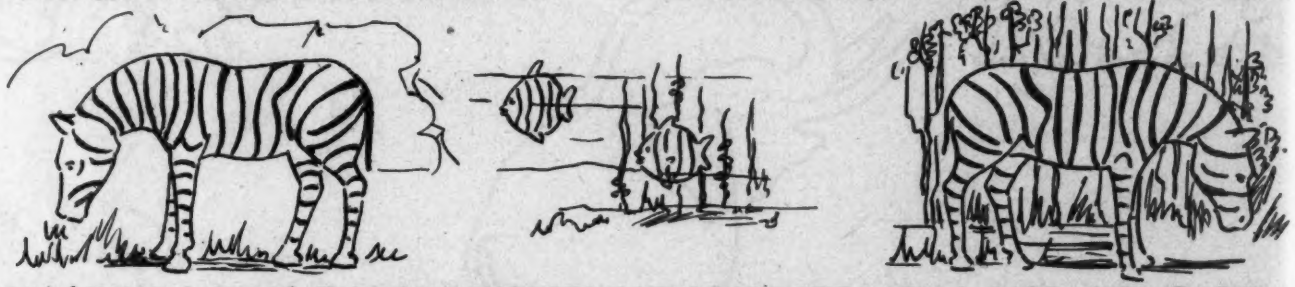
Countershading

NATURE USES COUNTERSHADING TO PROTECT PUTTING LIGHT AND SHADE INTO PLACES OPPOSITE TO WHERE THEY SHOULD BE. LIGHT UNDERSIDE. DARK TOPSIDE



A WHITE ANIMAL WOULD APPEAR LIKE THE ONE ABOVE. NOTE SHADOWS

NATURE MAKES TELLTALE SHADOWS WHITE AND DARKENS THE LIGHTED PARTS



MANY ANIMALS, BIRDS, FISH, AND INSECTS ARE PROTECTED BY A DISRUPTIVE DESIGN IN THEIR NATURAL ENVIRONMENT THEY BLEND IN WHILE ELSEWHERE THE PATTERN MAKES THEM APPEAR SOMETHING THEY ARE NOT

ALL WHITE WITH SHADOW. PROTECTIVE COUNTERSHADING. IN THE WATER

COUNTERSHADING IS MOST EFFECTIVE FROM A SIDE OR GROUND VIEW AND IS HARDLY SUITABLE FOR INDUSTRIAL PROTECTION. THE PROBLEM FOR AN AERIAL VIEW TENDS MORE TO FORM AND COLOR RESEMBLANCE. COUNTERSHADING AND DISRUPTION WITHOUT CONCEALMENT IS NOT GOOD CAMOUFLAGE AND MAY BE A BULLSEYE OF ATTRACTION. ——.

Plate 12. Camouflage course by Richard E. Bailey, chairman, art department, Central High School, Providence, R. I.

(Continued from page 130)

do the work himself and neglect the pupils, to the detriment of education, safety, and useful habits. Some instructors frequently are required to remain after school to print such jobs.

5. Tends to destroy the morale of the teacher who should inspire his classes in body and spirit, thus reducing him to a mere job holder.

6. Involves unsound economic practices, since the taxpayers are supporting an institution which competes unfairly with organized commercial printers and, in a way, tends to increase unemployment.

7. Denies the students the attention needed in guidance for developing individual differences.

8. Creates a spirit of competition between commercial printers and the school shop; thus general support of printing education, by industry, is lacking.

9. Requires the pupils to follow directions rapidly without regard to the formation of orderly habits in the solution of a problem and in understanding each step.

10. Ties up limited shop materials and equipment, thereby developing idleness and consequent problems in discipline.

11. Often involves long press runs which decrease in educational value and soon become health hazards to the pupils.

12. Requires no originality or taste; develops no interest or job in printing as a fine art; and offers no exploratory experience in printing.

Suggested methods of using production, and to overcome some of its disadvantages:

1. Advanced students could be organized for production work after a thorough course in the fundamental processes.

2. Routine printed forms should be anticipated by the administrator and ordered long before they are needed.

3. Forms required in large quantities should be printed two or more at one time, and enough printed to last throughout the year.

4. Standardized office forms should be secured from the board of education.

5. Commercial linotype should be used on all printing jobs containing considerable copy, and it should be either electrotyped or left standing for future use.

6. A specimen book containing illustrations and detailed instructions on all printing needed by the school should be available in the shop at all times.

7. A record should be kept of all jobs produced in the shop, with an estimate of production costs.

Suggested regulations of production:

1. No work which is competitive to commercial plants should be printed in the school shop.

2. No work should be done for organizations outside the school.

3. All requisitions for printing should be approved by both the principal and the printing instructor. All orders should be entered in the school office.

4. Two weeks or more time should be allowed for printing orders, depending upon the difficulty of the job and the experience of the pupils, and upon the amount of time required to obtain paper and other materials.

5. All copies for jobs sent to the print shop should be typewritten. The instructor should provide instructions on how to prepare manuscript.

6. The printing instructor should be consulted as to the educational values in a printing job.

7. The printing jobs should involve the processes already studied or being studied at the time the order is given.

8. Instructors should print copies of shop regulations regarding production for all teachers and outside organizations seeking printed jobs.

WHITTLING-JACKKNIFE TECHNIQUE

W. BEN. HUNT

Hales Corners, Wis.

(*Continued from page 28 of the January, 1944, issue*)

Ethiopian Boy's Head

Every whittler at some time or other has the urge to try to whittle a head. The little fellow illustrated herewith may be a good project to start with, as the whittling is not too difficult. No attempt was made to get the texture of his short kinky hair, the hairline only being shown.

This was such an interesting piece of work and was so quickly whittled that photographing the different steps was forgotten. In two

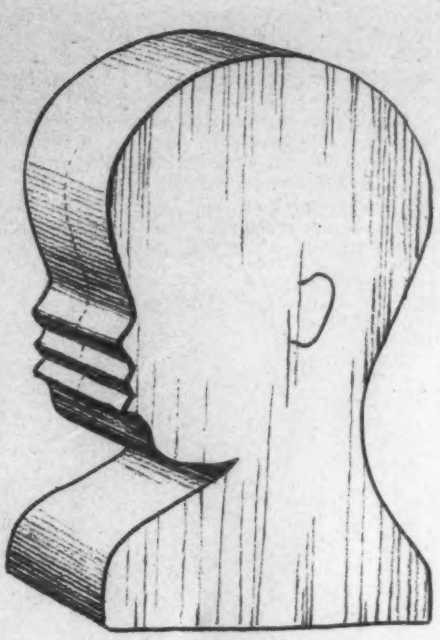
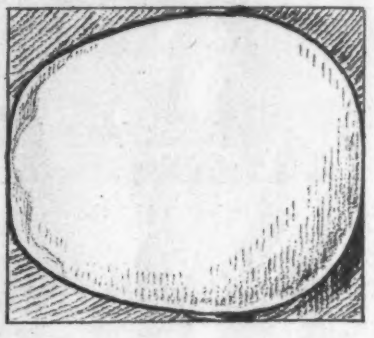


Fig. 140. Silhouette



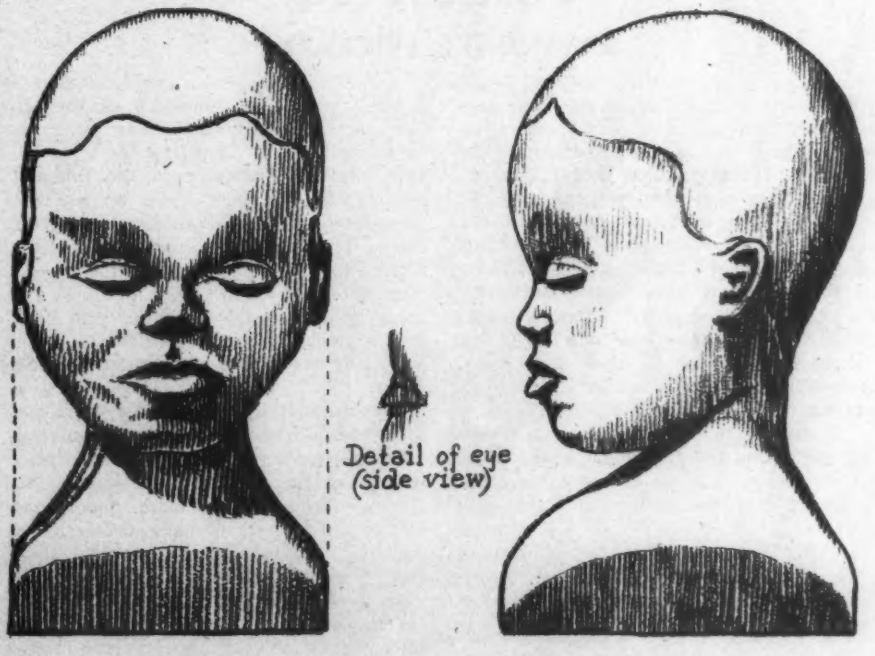


Fig. 139. Ethiopian boy — full-sized pattern

hours the job was completed, including staining. The waxing was done the next morning when the stain had dried. It was whittled out of a piece of mahogany 1⅞ by 2⅛ by 3⅝ in.

Study Figures 139 and 141 carefully before beginning to whittle. The side view of Figure 139 may be used as a full-size pattern. Cut out the silhouette (Fig. 140) very carefully, as the exactness of the sawing will be appreciated very much after you start whittling. It is advisable to saw just up to the outline, leaving the line stand. That will give enough wood to finish up nicely, especially where the nose and lips are concerned.

The ears should be traced and drawn on each side, as they come out to the edge of the block, as shown in Figure 139.

Before starting to whittle, draw a line down the center front and indicate the position of the eyes, and the width of the nose and lips. Look at the top view also and start forming the top of the head, working downward.

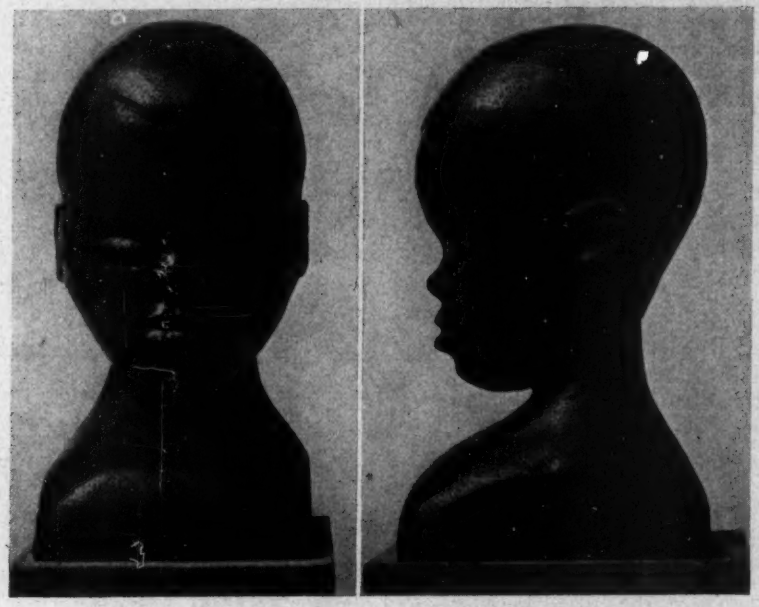


Fig. 141. Front and side view of the Ethiopian boy

GRADING IN TERMS OF OUR OBJECTIVES

RAYMOND E. ERICKSON*

Modern day industrial-arts teachers recognize the fact that shop courses do many things for pupils other than the teaching of manipulative skills. As a result of this knowledge, we have the 13 objectives of industrial-arts teaching as developed by the Committee on Standards of Attainment in Industrial Arts Teaching of the American Vocational Association. It is observed, however, that although much is said about these outcomes, and provisions are made for their attainment, frequently they are given little or no attention in determining the final grade.

In an effort to overcome this shortcoming and to put the proper emphasis on the various points that we hope to attain, the following chart was devised and used with success.

It will be noted that the number of points vary for the different areas. This is to allow more emphasis on some than on others.

*Shop Instructor, Dallas Technical High School, Dallas, Tex.

The pupil is first allowed to go through the chart and mark the various points as he "sees himself." The teacher must direct this part carefully so the different points will be given more or less the same interpretation by all members of the class. The instructor then checks the papers to change or confirm the pupil's opinion of himself on any or all areas. The points are then totaled and the term letter grades given by distributing the totals on a normal curve or as the instructor sees fit.

The original purpose of this chart was to provide a means of arriving at an equitable grade for the pupils, but experience has shown that its use as a teaching device is of equal, if not more, importance. If the instructor will make a practice of calling individual conferences with those pupils whose charts have been changed extensively, he will find that it affords an excellent opportunity to approach and offer suggestions for improvement on the pupils' weak areas. It is surprising to find the number of pupils among those weak in the abstract areas who are willing to conform to higher standards once their weaknesses are pointed out and more desirable standards set up for them. The desire to improve can be further motivated by connecting each point with a straight line, thus forming a graph. The use of a different colored line each term will enable the pupil to see the results of his efforts and many pupils will put forth much additional effort in an attempt to move their lines farther and farther to the right.

SELF-RATING CHART

Junior-Senior High School — Industrial-Arts Department

	1	2	3	4	5	6
I. RELATED WORK (20 points)						
a. Neatness						
b. Completeness						
c. Originality						
d. Promptness						
II. QUARTERLY TEST (10 points)						
a. Rank in class						
b. Score						
III. CONSTRUCTION TECHNIQUE (30 points)						
a. Ability to read a working drawing						
b. Speed						
c. Doing of tool skills in best way prescribed						
d. Ability to proceed in an orderly manner in doing your work						
e. Care and management of tools						
IV. ACCURACY (10 points)						
a. All parts of project to exact dimensions						
b. All surfaces smooth and even						
V. COOPERATION (10 points)						
a. Courtesy						
b. Good citizenship						
c. Obedience to authority						
VI. SELF-RELIANCE AND CONFIDENCE (10 points)						
a. Initiative						
b. Leadership						
c. Judgment						
VII. PERSISTENCE (5 points)						
a. The habit of doing a thing when it should be done whether it is a pleasant task or not						
VIII. HEALTH AND SAFETY HABITS (5 points)						
a. Desirable attitudes and practices with respect to health and safety						

Industrial arts, at its best, is informative, inspiring, exploratory, and foundational. It is basic to continued understanding of the mechanical and artistic in our surroundings. It is interpretive of home, school, community, and more distant places and groups. It is about the world and its people more than about any subject or section of the offering. It is a sampling explanation of industry in the large, in all of its physical and human ramifications. It advances a boy or a girl, a man or a woman at leisure, toward discerning and competent citizenship. — *Homer J. Smith.*

If you know how to spend less than you get, you have the philosopher's stone. — *Benjamin Franklin.*

Today our schools, face to face with a critical personnel and equipment shortage, are doing a big job in a big way. As the tempo of our war effort is accelerated the attention required by our returned fighting men and the educational demands of farsighted war workers will place a tremendous additional load on the facilities of the nation's schools and school shops. Because of this constantly pyramiding responsibility, plans must be made and additional equipment acquired. Furthermore, and we make this statement frankly — tomorrow's plans are today's problems — problems which must be solved now if we are to efficiently and intelligently meet the demands which war's end and the postwar period will impose.

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The ABC of Character Education

DELLA GERVIN FREEMAN*

Volumes have been written about character education in recent years. Nevertheless, the subject is so broad and is filled with such profound meaning that the surface has scarcely been scratched. Many educators believe that character can only be taught through living an exemplary life. That to examine character under the microscope of investigation is to lose the essence as though a vapor were diffused into the atmosphere. Some teachers believe that character is of such intangible elements, largely inherited from our ancestors, that it will not stand the disecting probe of reasoning. Yet others believe that character is "made of sterner stuff" and can be broken down into its component parts, even though there are an infinite number of those determining factors which vary in degrees of importance. However, an analysis would tend to bring the essential traits before the mind in a concrete form so that the abstractness of the qualities is reduced to a low intensity. If the latter be true, then character should be a teachable subject. If the identity of character can be separated and viewed from many angles, then the unity of character is no more foreign to the intellectual comprehension than mathematical equations or historical data.

*Stair Technical High School, Knoxville, Tenn.

Having accepted a theory — character can be dismembered into traits which will stand the test of classroom instruction — the next step is that of accepting the challenge of proving that the concept is true. This is not a new opinion, but it is difficult to make the ideal practical, and to make the general specific. Books are gathering dust on the library shelves because they are overflowing with theories and impressions which too quickly leave the bewildered teacher to find his way through a maze of fluent phrases and popular terms. To actually apply the information in a classroom situation takes an endless amount of patience for revising and for sifting fact from fancy.

The faculty in a technical school is especially concerned over this issue because employers demand in a universal cry, "We want workers with character." They look down from their seats of authority and accuse the schools of not teaching the old virtues of honesty, industry, prudence, and the like. To prepare the best type of worker requires that this hurdle be cleared. By so doing we can meet the demand of the market for our product, a good workman.

For our *ABC's* let us begin with three of the most important aspects of character education, namely: ambition, bravery, and cleanliness. Decision, economy, and faith could be added. One can with a bit of thought go through the alphabet, sum them up and the grand total is *CHARACTER*.

After a series of experimentations and after years of searching for lesson plans which are transferable from person to person, one learns that the best teacher must of necessity adjust concepts to the aptitudes of his students and to the cultural pattern of his community. Therefore, much is wisely left to the initiative of the instructor. The three briefly developed ideas presented here are merely to prime the fire of enthusiasm which may have burned low.

An Introduction to Character Education

A large chart attractively made to catch the interest of the students can be kept for reference from time to time. Variety will increase the effectiveness of the technique. It is a bit new for them to visualize the addition of words rather than of numbers. Such a novel plan aids in impressing the totality of character — the wholeness of self. They more quickly learn the new terms and become acquainted with the concept of building a life of which they are proud, one that is a part of their destiny, a sum total that cannot be erased to change the answer.

(Continued on page 24A)

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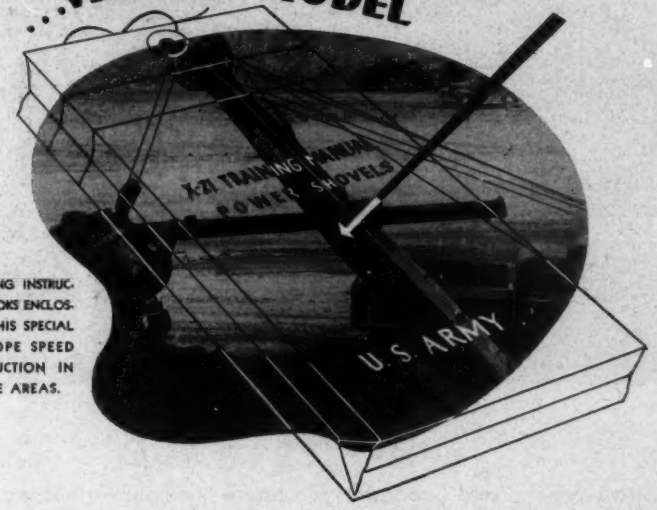

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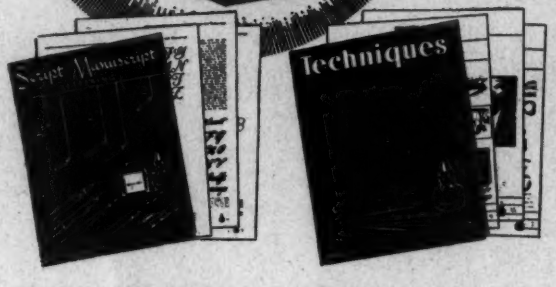

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(Continued from page 22A)

Group discussions inspired by stories and biographies arouse a keener awareness to the idea of becoming more like a chosen hero. Poems may be the best medium of reaching the ideals and spiritual recesses of those shy and timid students. Why should the teacher back away from the revelation of the soul? There is a bountiful supply of printed materials for consumption in the accomplishment of this introduction. One finds maturing children eager to question and to investigate those hidden channels of thought that really hinge on "why they are and what they are." A few hints to the teacher can be wisely pondered:

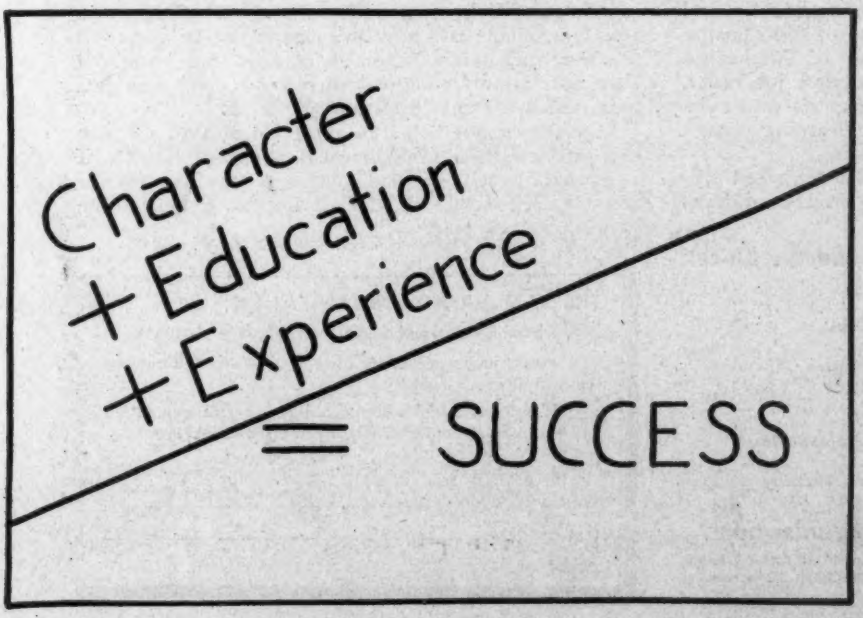
1. Never avoid seeing the clay feet of the hero. Such an act causes the pupils to doubt the sincerity of the entire program.
2. Never preach.
3. Never argue or *overdo*. A point which is stressed to the degree of irritation is a bad bargain at any price.

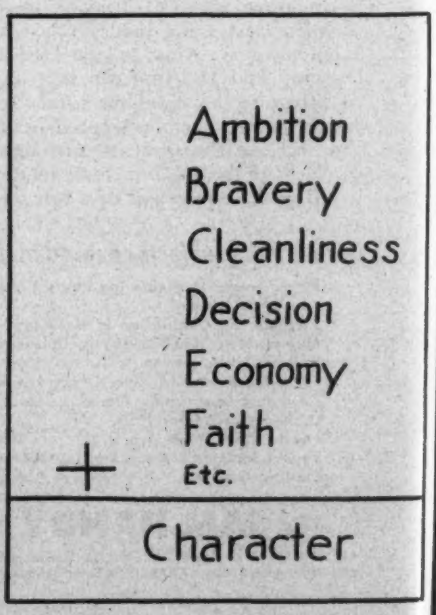
Such catchy jingles as the following plant a very productive seed of thought:

"Sow a thought
Reap a word,

Sow a word
Reap an act,

(Continued on page 26A)





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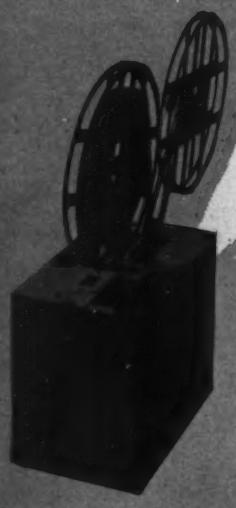

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(Continued from page 24A)

Sow an act
Reap a habit,

Sow a habit
Reap a character,

Sow a character
Reap a Destiny!"

Ambition

Ambition is a desirable character trait which is discussed over the teacup, across the banquet table, and in the conference room. It is the magic potency which spans the sometimes narrow gulf between success and failure. It is well to desire success, to want riches, to seek fame. But, to strive for success with the ruthless power of a heartless dynamo, to reach for riches with the clutching claws of greed, and to clamor for fame with an egotistical cry is to degrade ambition, to make of it an alloy, and to defile the integrity of character. If that is all that ambition means it becomes a meager quality, limited by false aspirations erected from a shallow soul; it becomes a compound of true ore mixed with sediments from human selfishness and ungoverned wants. Ambition can become a fire consuming the earliest hopes and erasing the adolescent dreams which should be carried as a shield against the gnawing of hunger for a destitute honor and the yearning for the glitter of material trifles. Ambition can be an armor when cast from lofty visions and molded in idealism. Then it is the thread of intrinsic value which, woven through the tapestry of life, gives strength and tone to the color of the whole self, and it magnifies character.

Something of the inspiration and common sense of this concept can be conveyed to the students. They are receptive to factors which aid in making their hopes change into definite goals. If attitudes of right and wrong are basic principles for ambition there is little to fear.

It is not enough to think abstractly of this trait, but the student must be led to realize that ambition is a growing quality which can be nurtured through habits of good workmanship. Such simple rules as these can be used as an initiation toward an understanding of more complex psychological laws of habit formation:

1. Learn to do things right *all* the time.
2. Try to make improvement *each* day.
3. *Never* be a quitter.

One effective method for thinking this lesson through in a personal way is to have each student prepare a chart which he can check for a specified time. Once a week or more is usually essential to show any appreciative progress. It should not be so often as to cause annoyance but should be stressed sufficiently to gain results. This chart is easily understood and is not time consuming.

Balance the Scales of Ambition

"Positive Weights"	*Yes*	*No*	*Yes*	*No*
1. Do you do your best works?		√	√	
2. Do you recheck with the directions?		√	√	
3. Is your work neat and attractive?	√		√	
4. Is your work finished on time?	√		√	
5. Were you pleasant about doing your work?		√	√	

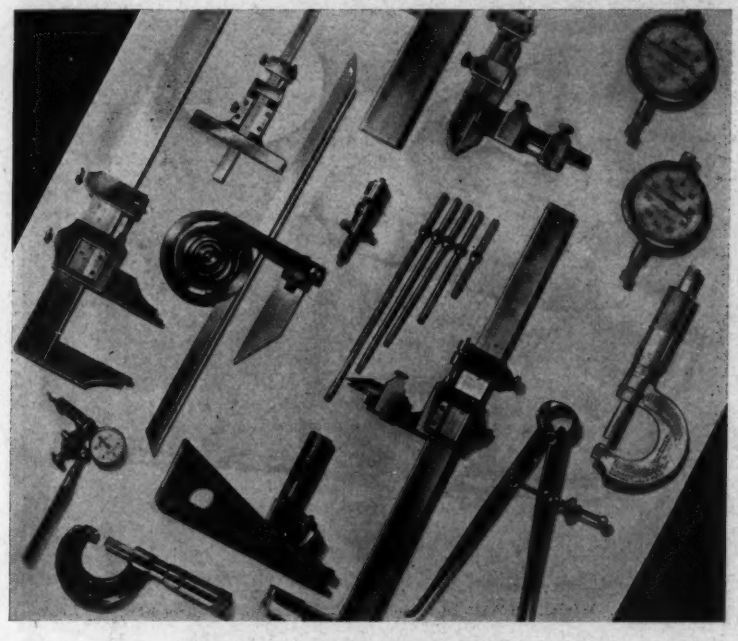
"Negative Weights"	*Yes*	*No*	*Yes*	*No*
1. Do you waste time?		√		√
2. Do you waste materials?	√			√
3. Do you argue over following directions?	√			√
4. Do you give up when you have difficulty?		√		√
5. Do you ignore your mistakes?		√		√

Bravery

Bravery is a common word. It slides through our lives as jewels through the fingers. All face some secret fears, shoulder heavy burdens, carry frightening responsibilities which weigh heavily upon character. It is in the everyday course of affairs of living that one is truly brave. Defying those fears, lifting those burdens, and assuming those responsibilities, with a smile on the lips — that is bravery. Conquering those trivial disturbances, which break the placidity of the normal sequence of events, with a calmness born of faith — that is bravery.

Perhaps the ensuing practical suggestions

(Continued on page 29A)



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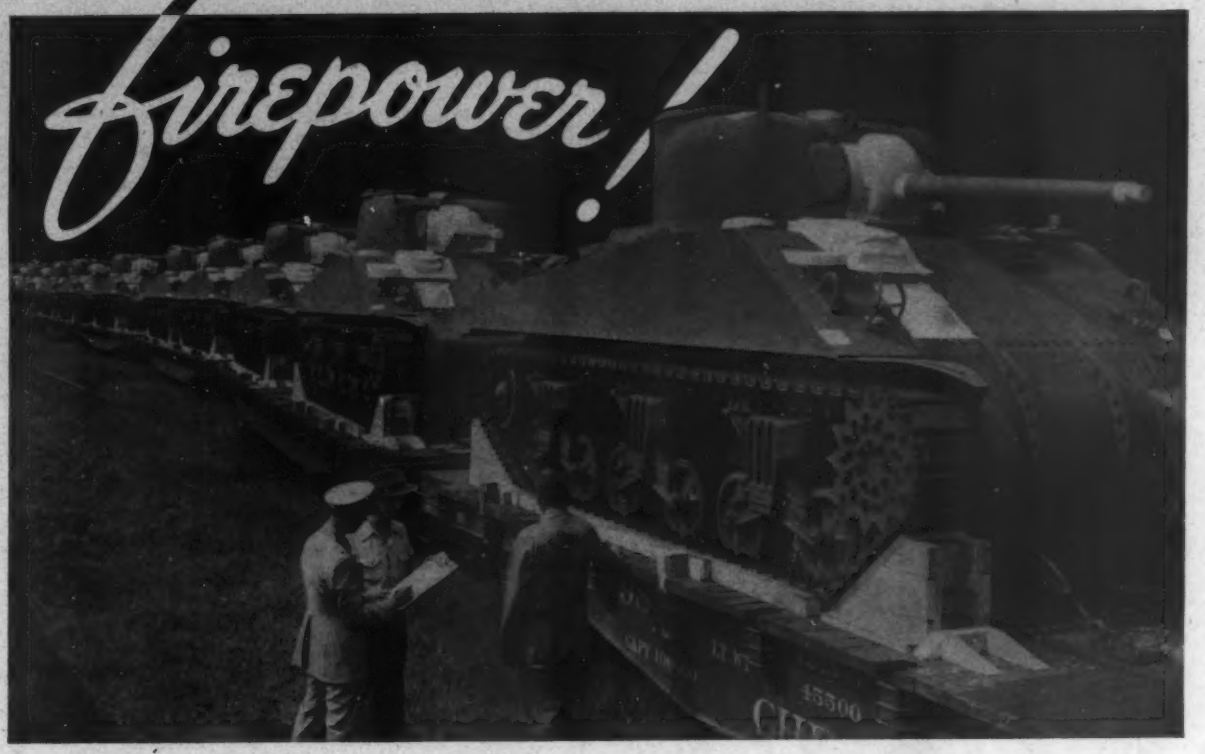

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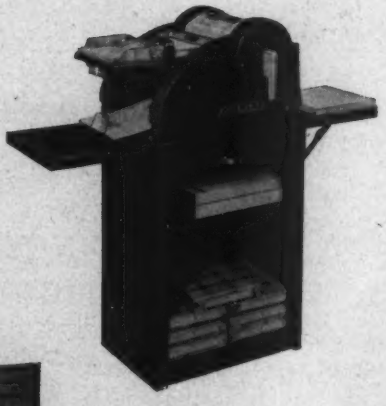

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94. Sharpening an Angular Cutter

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95. How to Check and Surface Foundations
96. Aligning and Installing Auxiliary Machinery
97. Filing and Installing Chocks
98. Laying Out, Drilling, and Tapping Flanges on Sea Chest
99. Installing Valves and Strainer on Sea Chest
105. Measuring Pipe, Tubing and Fittings
106. Cutting and Threading Pipe by Hand
107. Cutting and Threading Pipe on a Power Machine
108. Making a Cold Bend on a Hand Powered Machine
109. Covering Hot and Cold Pipes

AIRCRAFT WORK

128. Sawing Template Metal
129. Filing Template Metal
130. Blanking Sheet Metal on the Squaring Shear
131. Blanking Sheet Metal with Hand Snips
135. Finish Forming by Hand
142. Tube Bending by Hand

FARM WORK

194. Reconditioning a Mower (Part 1—Cutter Bar)
196. Reconditioning a Two-Bottom Tractor Plow
197. Reconditioning a Grain Drill
198. Community Canning

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Partial list of films now available is shown at left. Many other subjects are now in production. They will be ready soon. To obtain full details on these—and forthcoming subjects—send the coupon below TODAY!

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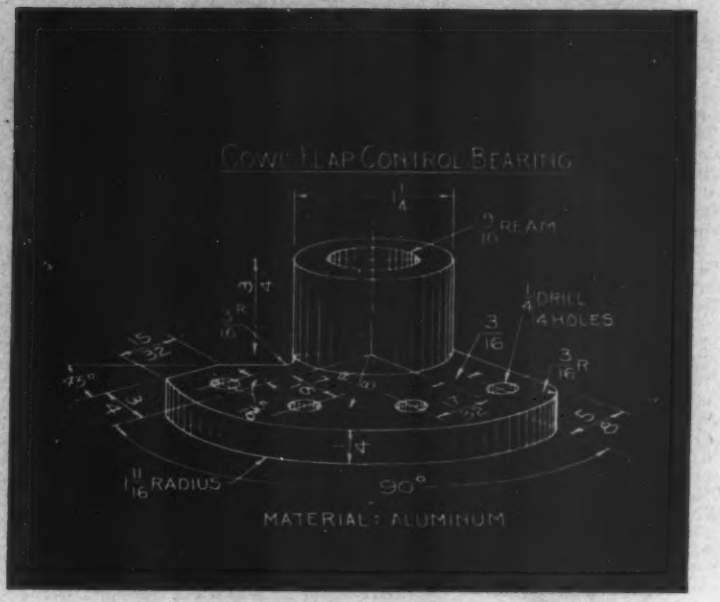

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TYPHONITE
ELDORADO

SCHOOL BUREAU, PENCIL SALES DEPT., JOSEPH DIXON CRUCIBLE COMPANY, JERSEY CITY 3, N. J.

(Continued from page 26A)

will open up highways of thought which will point to many avenues of approach.

1. What is bravery?

There are other kinds of bravery than just physical courage such as one shows when going into battle or when one risks his life to save a friend. The following concepts may give a broader meaning to this term.

Truthfulness: Don't be afraid to say "No" at the proper time. It takes strength to do the thing that you know to be right. There are no shades of right — it is pure white — any tone of color, however glamorous it may be, is wrong. Don't compromise with truth.

Activeness: Do something. Make a start toward the accomplishment of your ideals.

Progressiveness: Don't be afraid to keep ahead of the crowd. Never give up. Your goals are high; hold your banner aloft regardless of the sneering masses.

Self-confidence: You can obtain success if you apply the rules of the game. Don't doubt that you can. Have faith in yourself.

2. Can your students give examples to illustrate each of these character traits?
3. Allow them to try these:

Aids to Bravery

1. Smile!
2. Keep your conduct above reproach.
3. Be a good workman.
4. Be true to yourself.
5. Lend a helping hand.
6. Keep a healthy body.
7. Make friends.
8. Become a master of your occupation.
9. Smile!

Cleanliness

Cleanliness is a word of menial tone yet has ramifications which reach even unto godliness. We are all so sensitive to our environment that those standards and habits of conduct around us penetrate the fiber of our being as by a system of osmosis. Moral, spiritual, and physical cleanliness is the breath of character. It is easy to enter into a general discussion of the effect of dirt and of ugliness not only upon the outlook toward life but upon the degree of success ultimately attained. To have the skies dimmed by clouds which are torn and unclean casts a dingy shadow over the windows of the soul. To sweep the cobwebs from the horizon and to drench the atmosphere with showers of cleanliness lifts the perspective to higher plateaus of living.

The teacher and class are quickly carried back to the first thought of the introductory lesson:

"Sow a thought
Reap a word,

Sow a habit
Reap a character,

Sow a character
Reap a Destiny!"

If that destiny is to be a shining, spotless thing of pure beauty, cleanliness must govern the activities of each day.

Experience teaches that it is best to break the subject into several practical applications for the students. Be careful not to preach, yet do not shy away from sighting goals for achievement.

I. *Cleanliness of Body*

1. What does personal appearance mean?
2. Why is it so important?
3. Why does your appearance mean so much to the persons with whom you associate daily?
4. Why does your appearance play such an important role when you apply for a new job?
5. What effect does personal appearance have upon your attitude toward your work?

II. *Cleanliness of Speech*

"There is a little good in the worst of us
And a little bad in the best of us,
So it does not behoove any of us,
To speak ill of the rest of us."

1. Do you criticize other persons?
2. Define *criticism*.

You find that good criticism is a two-edged sword which can very easily revert to the wielder. You have not only to discover fault but to offer suggestions for improvement. That means that you should be interested in the problem and think it through to a more

(Continued on page 35A)

Metalworking Equipment, Tools, and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

AIR COMPRESSORS — for machine shop, foundry, or forge shop
ANVIL — 100 lb.
ARBOR PRESS — bench or pedestal type
BARROWS
- a) Coke
- b) Foundry
- c) Scrap

BELT LACER
BENCHES
- a) Coremaking
- b) For metal working, iron or steel legs. Tops, metal or hardwood lumber, 1¾ in. to 2½ in. thick
- c) Molding

BLACKBOARD — permanent or portable
BLOWERS — for furnaces, forges, etc.
BLOWTORCH — 1-qt. size
BOOKCASE — for reference books, catalogs, etc.
BORING BAR
BORING MILL — vertical or horizontal
BULLETIN BOARD
CABINETS — Wood or metal, for filing class records, instruction sheets, drawings, etc., and for tools and supplies
CASEHARDENING BOXES
CENTERING MACHINE
CHAIN HOISTS — differential, duplex or triplex
CHAIRS — teacher's, and tablet arm if needed for related-subjects room, or for demonstration section
CHUCK
- a) Drill, selected sizes
- b) Lathe, combination, 4 jaw, selected sizes
- c) Lathe, independent, 4 jaw, selected sizes
- d) Lathe, universal 3 jaw, selected sizes
- e) Milling machine, universal

CORE OVEN — for foundry
CRANES AND HOISTS — air, electric, or hand, of the jib, traveling, or portable type
CUPOLA — for foundry, coke, or electric, ¼- to 1-ton capacity
DESK — teacher's, with drawer compartments
DIE-FILING MACHINE
DIVIDING HEAD
DRILLS
- a) Bench, hand
- b) Breast
- c) Electric, portable
- d) Hand
- e) Post, hand or power
- f) Radial
- g) Sensitive
- h) Upright, power

FLASKS — 2 or 3 part, steel or snap type
FORGE — coal or gas, with hand- or electric-driven blower
FURNACES
- a) Annealing
- b) Bench
- c) Brass and soft metal
- d) Combination bench
- e) Casehardening
- f) Cyanide
- g) Gasoline
- h) Heat-treating
- j) Melting

GEAR-CUTTING MACHINE
GRINDER
- a) Bench, hand or power driven
- b) Combination grinder, buffer, and polisher
- c) Emery, bench or pedestal type
- d) Face, with magnetic chuck
- e) Portable tool post
- f) Precision, for external and internal grinding
- g) Universal tool cutter, drill and reamer grinder
- h) Wet tool

HACK SAW — motor or belt driven
HAND PICKS — for cleaning inside of cupola, 1¼ to 2½ lb.
HARDNESS TESTING MACHINE
LATHES — belt or individual drives
- a) Automatic
- b) Bench, 6-in. to 11-in. swing, 11 in. to 36 in. between centers
- c) Change gear, 9-in. to 14-in. swing, 18 in. to 36 in. between centers
- d) Quick-change gear, 9-in. to 16-in. swing, 18 in. to 36 in. between centers
- e) Semiquick-change gear, 9-in. to 18-in. swing, 18 in. to 42 in. between centers
- f) Turret
- g) Metal spinning

MILLING MACHINE
- a) Plain, cone or motor-driven type
- b) Universal, cone or motor-driven type

NIBBLING MACHINE
PIPE CUTTER
PLANER — belt or motor driven
POWER HAMMER — for forging operations
PUNCHES — metal, hand, or power
PYROMETER
PYROSCOPE
RELIEVING ATTACHMENT FOR LATHE
SAND SIFTER — for foundry, hand or power
SANDBLAST OUTFIT — with cabinet
SCALE
- a) Counter for machine shop
- b) Platform, for foundry, 1000-lb. capacity

SHAPER
SNAP-FLASK JACKETS — to fit snap flasks used
STRAIGHTENING PRESS
SURFACE PLATES
SWAGE BLOCK AND STAND — for forge shop
TAPER ATTACHMENT FOR LATHE
TRUCK — warehouse
TUMBLING BARREL — for foundry
VISES
- a) Blacksmith
- b) Drill press
- c) Machinist
- d) Pipe
- e) Planer
- f) Shaper

WELDING OUTFIT
- a) Acetylene
- b) Electric

Metalworking—Small Tools

ARBORS
- a) Drill chuck to suit requirements
- b) Reamers, various sizes
- c) Shell tool, various sizes
- d) Straight shank for shell reamers and shell drills, selected sizes
- e) Taper shank for shell reamers and shell drills, selected sizes

BEARING SCRAPER
BELLOWS — for foundry class
BEVEL PROTRACTOR
BROOMS AND FLOOR BRUSHES — for shop and foundry
BRUSHES
- a) Bench
- b) Core box
- c) Core painting
- d) Hard brushes for foundry
- e) Floor
- f) Soft brushes for foundry

BULB SPONGES — for molders
DRAW PINS — for molders
CALIPERS
- a) Hermaphrodite, 4 in. and 6 in.
- b) Inside, 4 in. and 6 in.
- c) Outside, 4 in. and 6 in.

CANS
- a) Oil, 1/3 pt., 1 pt., and 10 gal.
- b) Waste

CENTER TESTERS
CHISELS
- a) Cape, 3/8 in. and 5/8 in.
- b) Cold, 5/8 in. and ¾ in.
- c) Diamond point, 3/8 in. and ½ in.
- d) Roundnose, 3/8 in. and ½ in.

CLAMPS
- a) 4 in., 6 in., 8 in., and 10 in.
- b) Flask, for foundry
- c) Strap, various sizes

CAKE FORKS — for foundry
COLLETS
- a) For milling machine, selected sizes
- b) For lathe, selected sizes

COMBINATION SQUARES—with hardened head and blade, and protractor head, 9 in. and 12 in.
COUNTERBORES — straight and tapered shanks, selected sizes
COUNTERSINKS — for metal
CRUCIBLE TONGS — to fit crucibles
CRUCIBLES — selected sizes
- a) Shanks, single end to fit ladles
- b) Shanks, hand, to fit ladle bowls

CUTTERS — angular milling, bevel gear, concave milling, convex milling, end milling, face milling, formed milling, grooving, involute gear teeth, key seat, side milling, and metal slitting

DIVIDERS — Spring, 4 in. and 6 in.
DRILLS
- a) Drifts, different sizes
- b) Sleeves, different sizes
- c) Stand for Nos. 1 to 60
- d) Stand for 1/16 in. to ½ in. by 64ths

DRILLS
- a) Center
- b) High speed, taper shank, various sizes
- c) Jobbers, straight shank, 1/16 in. to ½ in. by 64ths
- d) Ratchet
- e) Straight shank, Nos. 1 to 60
- f) Taper shank, ½ in. to 1 in. by 16ths

FILE CARDS
FILES
- a) Die sinkers, various shapes
- b) Flat bastard, 8 in., 10 in., 12 in., and 14 in.
- c) Half round, double cut, 6 in., 8 in., 10 in., and 12 in.
- d) Hand, smooth, 8 in., 10 in., and 12 in.
- e) Mill, smooth, 8 in., 10 in., and 12 in.
- f) Round bastard, 8 in., and 10 in.
- g) Square bastard, 8 in., and 10 in.
- h) Swiss, various shapes
- j) Three-square, double cut, 6 in.
- k) Warding, double cut, 6 in.

FIRST-AID CABINET AND SUPPLIES
FORGE TOOLS — drift pins, flatters, fullers, hand and handle punches, hardies, hot and cold cutters, set hammers, and swages for the forge shop
GATE STICKS — maple, for foundry
GAUGES
- a) Center
- b) Depth
- c) Drill and wire
- d) Screw pitch, select kinds
- e) Surface
- f) Thickness

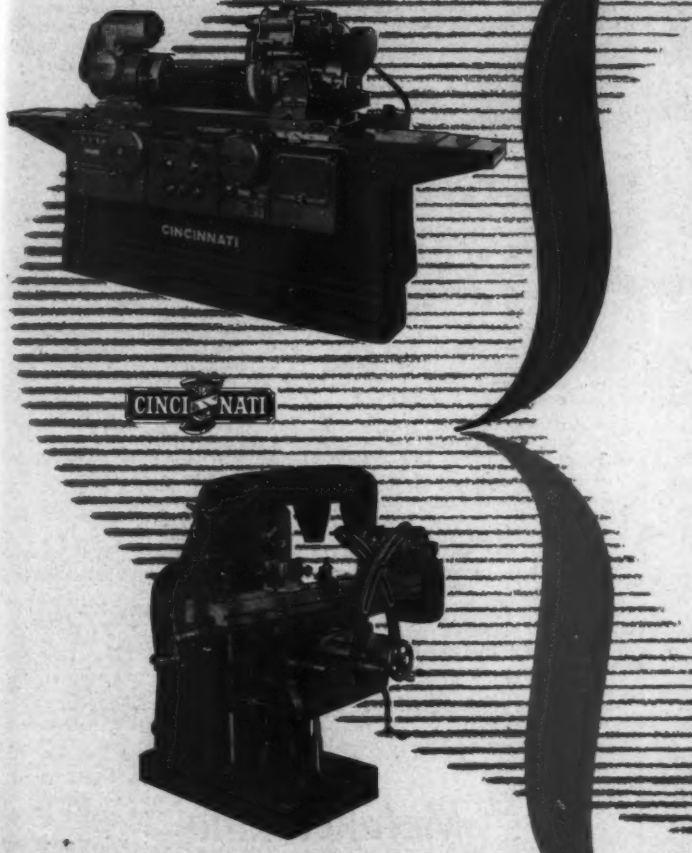
GLOVES — asbestos, for foundry
GOGGLES
- a) For machine shop
- b) For foundry

HACK SAW
- a) Blades, hand, 18T, 10 in.

(Continued on page 32A)

IF THEY WERE YOUR BOYS

you would want the best



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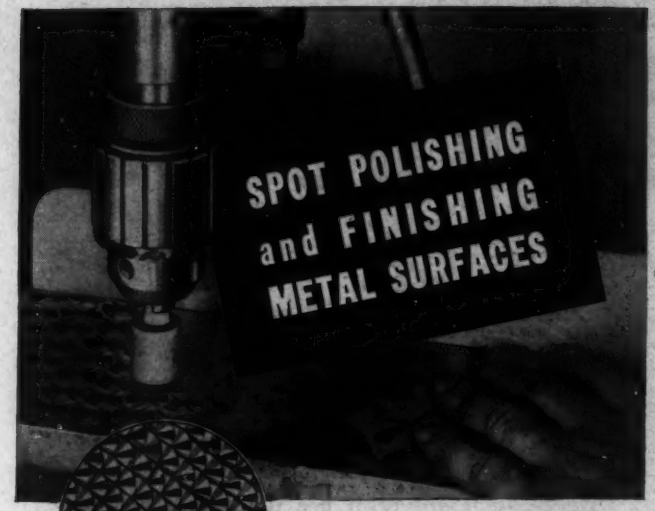

...in your own shop

Surface coatings of rust or gummy film which accumulate on the machined tables and guides of jig saws, band and bench saws are quickly removed and a new precision-looking finish given to machined surfaces by "spot polishing."

The method is simple. The polishing tool (shown above in the Jacobs chuck) is a section of dowel tipped at the working end with a disc of leather or felt. On this disc is put valve grinding compound or powdered emery in oil. The drill press is run at slow speed and the disc brought into contact with the surface to be polished. A few seconds' contact leaves a smooth, bright spot. By repeating the operation, overlapping the spots, a pattern like that illustrated will be obtained.

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(Continued from page 30A)

- *b*) Blades, power, 14T, 12 in.
- *c*) Frames, adjustable

HAMMERS
- *a*) Babbitt
- *b*) Ball peen, 13 oz., 16 oz., or 20 oz.
- *c*) Blacksmith's, various kinds
- *d*) Riveting, 9 oz., and 12 oz.
- *e*) Setting

INDICATOR
- *a*) Center
- *b*) Universal or universal dial test
- *c*) Speed

KNURLING TOOL — with assorted knurls

LADLES
- *a*) Bull
- *b*) Hand bowls
- *c*) Melting

LATHE DOGS — ½ in., ¾ in., 1 in., 1½ in., 2 in., 2½ in., and 3 in.

LEGGINGS — fireproofed duck, to protect students when pouring in foundry

LEVEL — 6-in. bench

LIFTING SCREWS — for molders

MALLETS — wood or soft

MANDRELS — selected sizes

MICROMETERS — inside, 1½ in. to 8 in.; outside, 0 to 1 in.; outside, 1 in. to 2 in.; outside, 2 in. to 3 in.

MOLDING BOARDS

MOLDING STICKS AND TROWELS — various kinds

NIPPERS — end cutting, 5 in.

OIL STORAGE TANK — with pump

OILSTONES — medium and fine

PAILS — galvanized, 12-qt. capacity for foundry

PARALLELS
- *a*) Adjustable
- *b*) Steel, assorted sizes

PLIERS
- *a*) Combination, 6 in.
- *b*) Side-cutting, 6 in.

PUNCHES
- *a*) Center, ¼ in. and ⅜ in.
- *b*) Hollow, ½ in., ¾ in., and 1 in.
- *c*) Pin, ⅛ in., 5/32 in., 3/16 in., 7/32 in., and ¼ in.
- *d*) Prick, ¼ in.

RAMMERS — for foundry
- *a*) Hand
- *b*) Floor

REAMERS — various sizes
- *a*) Adjustable
- *b*) Hand
- *c*) Taper pin
- *d*) With taper shank

RIDDLES — ¼-in. and ⅛-in. mesh, 18-in. diameter, for foundry

RIVET SETS — assorted sizes

SCALES
- *a*) Steel, 6 in., graduated 1/64 in. to ⅛ in.
- *b*) Steel, 12 in., graduated to 32nds

SCREW DRIVERS — 6 in. and 9 in. blade

SCRIBERS

SHOVELS
- *a*) Coke
- *b*) Sand

SNIPS — tin, 3 in. straight and 3 in. curved

SOCKETS — for taper shanks, drill and tools, selected sizes

SOLDERING COPPERS AND HANDLES — 1-lb. size

SPRAY CAN — for molders

SPRINKLING CANS — galvanized iron, 16-qt. capacity, for foundry

SPRUE PICKS — for molders

SQUARES
- *a*) Machinist's, 6 in.
- *b*) Blacksmith's

STEEL FIGURES, ⅛ in.

STEEL LETTERS — ⅛ in.

SWABS — for molders

TAPELINE — steel, 25 ft.

TAPS AND DIES
- *a*) Machine screws
- *b*) Pipe
- *c*) N.F. ¼ in. to ¾ in.
- *d*) N.C. ¼ in. to ¾ in.

TONGS
- *a*) Blacksmith's, various kinds
- *b*) Pick up, for foundry
- *c*) Shake out, for foundry

TOOL HOLDERS
- *a*) Boring tools
- *b*) Cutting-off tools
- *c*) Planer
- *d*) R.H. and L.H. offset shank
- *e*) Shaper
- *f*) Slotter
- *g*) Straight shank
- *h*) Threading

TOOL-HOLDER BITS — square, ¼ in., 5/16 in., ⅜ in., 7/16 in., ½ in.

TRAMMEL POINTS

V BLOCKS AND CLAMPS

WHEEL DRESSER

WRENCHES
- *a*) Adjustable, 8 in. and 10 in.
- *b*) Pipe, 8 in. and 12 in.
- *c*) Tap, adjustable, various sizes

Metalworking— Materials and Supplies

ABRASIVE CLOTH — aluminum oxide. Grits 320 to 24, obtainable in sheets or rolls from 1 to 28 in. wide

ABRASIVE WHEELS

ACETYLENE GAS — in drums for welding

ALUMINUM
- *a*) Pigs for foundry
- *b*) Sheets, tubing, rounds, shapes, wire, etc.

BABBITT METAL

BEARING BLUE

BELT DRESSING

BELT LACING MATERIAL

BELT LEATHER

BOLTS
- *a*) Carriage, selected sizes
- *b*) Lag, selected sizes
- *c*) Machine, selected sizes
- *d*) N.F., selected sizes
- *e*) Stove, flat or roundheads, selected sizes

BRASS
- *a*) Bars, 3/32 in., ⅛ in., 4/16 in., and ¼ in. thick; ⅜ in. to 1 in. wide, 8 ft. to 10 ft. long, selected sizes
- *b*) Round rods, 3/16 in. to ½ in. by 16ths, selected sizes
- *c*) Sheets, 28 to 32 American gauge, 12 in. wide by 72 in. to 84 in. long, selected sizes

(Continued on page 36A)

Free

—this valuable Delta book

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Circular Saw and Jointer — Complete information on construction and use of 10" Tilting Arbor Saw and 6" Jointer. Includes: Ripping; Saw Projection; Use of Moulding Fence; Cross-cutting; Miters; Cutting to Length; dozens of other subjects.

Shaper — Adjustments; Cutters and Collars; Shaping with Guides, with Collars, with Patterns; Forms, Jigs, Fixtures; etc.

Band Saw and Scroll Saw — Complete data on Band Saw Blades; Ripping and re-sawing; Use of Standard Fence; the Ripping Blade; Ripping Curves; Tilt Table; many other subjects.

Abrasive Tools — Grinder, Buffer, Belt Sander, Disk Sander, attachments; How to Sharpen Tools; Grinding Shaper Cutters; etc. Also appendix of terms and tables.

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Gruelling production-line applications in war industry *again prove the* Quality, Safety, Dependability of Delta Power Tools

..long recognized in school shops

Consequently, Delta tools by thousands have gone into war plants and directly into government service — but this does not always mean that you cannot obtain Delta machines for instruction purposes.

The need for trained manpower in war industry is at a critical point. Pre-induction training of your older boys, now becomes more important than ever. Your ordinary instruction program calls for careful review and planning. Re-training for peacetime production is ahead.

It is a good time to take a new look at your requirements, and prepare with adequate equipment for these continuing responsibilities — in a program where many school systems already have made contributions to be proud of.

Priorities are available on machines for essential war purposes — and, under a recent regulation, you can buy many low-cost Delta machines for general school purposes *without a special priority.*

Contact your Delta distributor. Investigate availabilities for immediate needs — and to aid in post-war planning, write on your letterhead for valuable book, "How to Plan the School Workshop" — it's free. B-3

Tear out this coupon and mail today!

THE DELTA MANUFACTURING CO.
661C E. Vienna Ave., Milwaukee 1, Wis.

Please send the new Delta catalog of low-cost power tools, and a copy of your book, "How To Plan the School Workshop."

Name.....

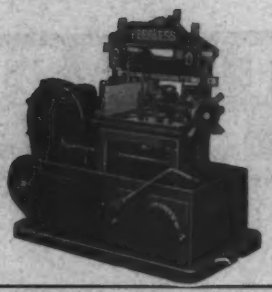
Position.....

Address.....

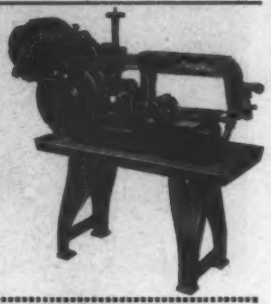
City.....(.....) State.....

Detroit Public Library

THE MORE THEY LEARN, THE MORE THEY WILL EARN



TRAIN THEM ON PEERLESS POWER METAL SAWS. . . . .



● Students gain more confidence in their ability to step right into a productive job when they are trained on the tools war industries use. Directors of vocational training know it reflects credit on the school, too, when the student is trained on machines found in everyday use in plants applying the most modern production methods.

Peerless Metal Cutting Saws are standard equipment wherever safe, accurate, fast, thrifty metal cutting is required. They have unique safety features which guard the student, the metal and the saw itself. They are automatic from the beginning to the end of the cutting cycle. Address Dept J for literature giving other features of the Peerless Saw.

PEERLESS MACHINE COMPANY
RACINE, WISCONSIN

Peerless
METAL SAWING MACHINES

FAST, ACCURATE CUTTING DEMANDS POSITIVE BLADE CONTROL

PEERLESS MACHINE COMPANY, Racine, Wisconsin (Dept. J)
Please mail ( ) Catalog of Peerless Standard Power Saws
( ) Catalog of complete Peerless line: Hydraulic, Vertical and Universal Metal Sawing Machines

Name .....
School or Company .....
Address .....
City and State .....

Detroit Public Library

(Continued from page 29A)

satisfactory solution. Such constructive criticism is justified for it is the reward of thorough analysis of a difficult situation.

Beware, for it is just a slight drop from loose criticism to gossip.

3. Define *gossip*.

4. Let us think of these things:

Guides for Clean Speech

a) Don't criticize people or things.
b) Don't talk about things you do not understand.
c) Don't talk to attract attention.
d) Don't gossip.

5. Rearrange these words to make a familiar quotation:

"As heart in a thinketh man his
is he so."

* * *

And so the floodgates are opened and thoughts strain for first place in the attention. Perspective is gained and the horizon is pushed back and back to the foothills of lofty aspirations as infinite possibilities illuminate the far vision. Surely, John Oxenham wrote these lovely words of truth to be used as an introduction for the fourth of the series of character traits, Decision:

"To every man there openeth
A Way, and Ways and a Way;
And the High Soul climbs the Highway,
And the Low Soul gropes the Low,
And, in between, on the misty flats
The rest drift to and fro.

But to every man there openeth
A High Way and a Low,
And every man decideth
The way his soul shall go."

THE GRAPHIC ARTS DOES A JOB

John M. Fontana*

If this article were written during the turn of the century, when most stories had two titles, I might append to the above, "or Winning the Boy Back to School." This is not a tale of a Merriwell or an Alger, but of a group of boys who had a feeling of not belonging. To them the classroom was an instrument of subjugation and not a place of learning. Their ages ranged from 13 to 14½, the mental age from slightly lower to approximately a year and a half above the oldest age. They had become a problem. What to do? How could we rehabilitate them? What type of work would they best be suited for? These were the questions the school had to rightfully answer for the boys.

More than two years ago, the school print shop opened for the first time. With the regular classes that met once a week this special group was assigned. This was by no means an ideal arrangement, for an industrial-arts course in printing requires lectures, demonstrations, proper habit formation, and much individual instruction during the early weeks of the course. Things went along smoothly, but the key question was how to keep the special group interested. Fortunately, the mystery of the print shop sold itself to the boys. What they learned during the day was supplemented by individual instruction after three o'clock. Not a boy left when the final gong rang. They volunteered to stay. I knew I had half the battle won, yet I could not rest and say my work was done. The motivation had begun but the job was not complete. The extracurricular sessions became links of friendship that gradually encompassed us. The boys came to recognize

*Somers Junior High School, Brooklyn, N. Y.

(Continued on page 39A)

HOW TO USE OPEN-END WRENCHES

Ask for FREE Data Sheet No. 22

There's more to the proper use of wrenches than most people think. This Williams' Data Sheet provides much useful information, offers safety suggestions, and explains a use "kink" that every mechanic should know.

Instructors and students will find Williams' Data Sheets helpful and practical, and they are furnished without charge. Subjects covered are listed below. Use coupon to order.

1. Data on "Superior" Wrenches.
2. Data on Boring Tools.
3. Data on Chain Pipe Tongs.
4. Data on "Supersocket" Wrenches.
5. Data on Lathe Dogs.
6. Data on Chain Pipe Vises.
7. Data on Turning Tools.
8. Types of "Superior" Wrenches.
9. Use of "Supersocket" Wrenches.
10. Data on Eye Bolts.
11. Data on "C" Clamps.
12. Use of Cutting-Off Tools.
13. Use of Knurling Tools.
14. External Thread Cutting.
15. Internal Thread Cutting.
16 to 21. Six Data Sheets on grinding cutters for Tool Holders.
22. Use of Open-end Wrenches.

MAIL THIS COUPON

J. H. Williams & Co., Dept. I-344, Buffalo, N. Y.

Please send Data Sheets circled below. ☐ for binders ☐ for posters

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*City*_____ *State*_____

Mail Coupon Today

WILLIAMS

SUPERIOR DROP-FORGED TOOLS

(Continued from page 32A)

d) Strips, 1/32 in. and 1/16 in. thick, ½ in. to 1½ in. wide, 50 ft. to a coil, selected sizes
e) Threaded rods, Nos. 6 to 10, in 24 in. lengths. Nos. 12, 14, ¼ in., and 5/16 in., in 24 in. lengths, selected sizes
f) Wire, soft, 8, 11, and 14 American gauge, selected sizes
g) Wire, spring, 8 to 22 American gauge, selected sizes

CASEHARDENING COMPOUNDS

CHAPLETS — single and double head

COAL
a) Charcoal for foundry or forge
b) Coke for foundry
c) Forge

COPPER
a) Pigs, for casting alloys
b) Sheets, 8 to 25 American gauge, 30 in. by 60 in., selected sizes
c) Tubing, outside diameters, 3/16 in., ¼ in., 5/16 in., ⅜ in., ½ in.; thickness of wall, 1/32 in.; lengths, 8 ft. to 12 ft., selected sizes
d) Wire, soft, 2 to 20 American gauge, in coils. Also in ¼, ½, and 1 lb. spools, sizes 16 to 36, English gauge, selected sizes

CORE
a) Compounds
b) Flour
c) Paste
d) Oil
e) Wax-vent wire

CUTTING COMPOUNDS

FIREBRICKS AND CLAY — for foundry

FIRE HANDLES — assorted sizes

GRAPHITE — for foundry

IRON — Pig, for foundry

LACQUER — transparent and colored, for finishing

NUTS — S.A.A., acorn cap, castellated, square, hexagon, joint, and wing, selected sizes and kinds

OIL
a) Boiled linseed
b) Lubricating
c) Quenching and hardening

PACKING
Round, sheet, square, or tubular

PAINT — back asphaltum

PINS
a) Cotter, 3/32-in. to ¼-in. diam. from ½ in. to 2 in. long
b) Flask, for flask repairs
c) Taper, Nos. 0 to 6, ¾ in. to 2 in. long

PUMICE POWDER

RIVETS
a) Copper, with burrs, Nos. 7 to 14, lengths, ⅜ in. to ¾ in., selected sizes
b) Iron, No. 14 gauge to 3/16 in., flathead or button head, ¼ in. to 1 in. long, selected sizes
c) Tinners', flathead, 8 oz. to 16 lb., either tinned or black, selected sizes

SAND
a) Molding, in 350-lb. barrels or 800-lb. casks
b) Parting, in 350-lb. barrels or 800-lb. casks

SCREWS
a) Flathead or roundhead iron or brass, selected sizes and kinds
b) Cap and machine, iron or brass, selected sizes and kinds
c) Set, head and headless

SOLDER — acid or rosin core; bar, or solid wire

SOLDERING PASTE OR SALTS

STEEL
a) Bessemer, rod, 1/64 in. to ⅜ in. by 64ths, in 4-ft. lengths, selected sizes
b) Bars, cold rolled, ⅛ in. to ⅜ in. thick, ½ in. to 2 in. wide, 12-ft. lengths, selected sizes
c) Drill rod, letter sizes, A to Z, number sizes, 1 to 80, in 3-ft. lengths, selected sizes
d) Rods, hexagon and square, cold rolled, ¼ in. to ¾ in., in 12-ft. lengths, selected sizes
e) Round, cold rolled, diameters ⅛ in. to 1 in., lengths 12 ft., selected sizes
f) Sheet, black, Nos. 18, 20, 22, 24, 26, 28, U. S. gauge; size of sheets, 24 in., 28 in., and 30 by 96 in.
g) Sheet, galvanized, Nos. 18, 20, 22, 24, 26, 27, and 28 U. S. gauge; size of sheets, 24 in., 28 in., and 30 by 96 in., selected sizes
h) Threaded rods, Nos. 6 to 10, in 12-in. lengths. Nos. 12, 14, ¼ in., and 5/16 in., in 24-in. lengths, selected sizes

TIN
a) Pigs, for casting alloys
b) 1C, 1X, 20 by 48 in.
c) 1XX, 20 by 48 in.

WASHERS AND BURRS
a) Copper, burrs, Nos. 3 to 14, in 1-lb. boxes
b) Iron burrs, Nos. 3 to 14, in 1-lb. boxes
c) Brass washers, 3/16 in. to ½ in. by 16ths
d) Iron washers, 3/16 in. to ½ in. by 16ths

WELDING FLUXES

WELDING RODS (all rods come in 24-in. lengths)
a) Brazing, 1/16-in., ⅛-in., and 3/16-in. diameter
b) Cast aluminum, 3/16-in., ¼-in., and ⅜-in. diameter
c) Cast brass, 3/16-in., and ⅜-in. diameter
d) Cast bronze, ¼-in. diameter
e) Cast copper, 3/16-in. and ¼-in. diameter
f) Cast iron, 3/16-in., ¼-in., 5/16-in., and ⅜-in. diameter
g) Low carbon steel, ⅛-in., ¾-in., and ¼-in. diameter

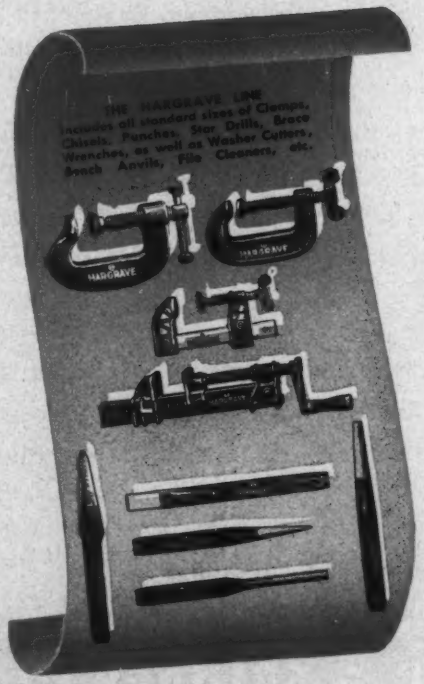
WHITE LEAD — for machine shop

WIRE
a) Annealed, 16 to 34 W and M gauge, selected sizes
b) Coppered market, 5 to 18 W and M gauge, selected sizes
c) Coppered spring, 2 to 18 W and M gauge, selected sizes
d) Galvanized, 5 to 18 W and M gauge, selected sizes
e) Piano, Nos. 2/0 to 36, selected sizes
f) Tinned, 16 to 24 W and M gauge, selected sizes
g) Wool, Nos. 0 to 3 in 1-lb. packages, selected sizes

ZINC
a) Pigs, for casting alloys
b) Sheet, Nos. 4 to 14, sheets 36 in. by 84 in.

THEY MUST HOLD UNDER TREMENDOUS STRAIN...

for Pontoon Bridges


THE HARGRAVE LINE
Includes all standard sizes of Clamps, Chisels, Punches, Star Drills, Brace Wrenches, as well as Washer Cutters, Bench Anvils, Pile Cleaners, etc.

The makers of HARGRAVE clamps are proud to have been designated by the U. S. Armed Forces to manufacture side-rail clamps used in the construction of pontoon bridges.

Each side-rail clamp is TESTED on our Production Power Testing Device to make certain it will stand the specified load. This is the *same test* to which the HARGRAVE Clamps *you buy* are subjected.

For sixty-four years, The Cincinnati Tool Company has produced Mechanic's Tools made to the highest standards, by expert workmen animated with a true spirit of craftsmanship. Throughout this period HARGRAVE Clamps and other Tools have played an important part in American industrial development.

Today, both on the fighting and production fronts, these *individually tested* Tools are helping to achieve a faster Victory. Such heavy demands make it difficult to fill all your orders as promptly as we would like. However, we are doing our best, operating twenty-four hours per day. See your supplier—he, too, will be glad to help.

HARGRAVE

INDIVIDUALLY TESTED TOOLS

THE CINCINNATI TOOL COMPANY . . . Waverly and Main Aves. . . . CINCINNATI 12, OHIO

TOOL-ROOM LATHES

PLAIN BENCH LATHES

HAND SCREW MACHINES

INTERNAL GRINDERS

A JOB WELL TAUGHT IS LONG REMEMBERED

Many a fine toolmaker and master mechanic remembers the exacting problems given by his instructor and proudly recalls how he mastered the seemingly impossible tolerances with the aid of a Rivett lathe or grinder. Likewise many a scientist and engineer justly acknowledges the part played by a Rivett machine in his research and new developments. Today these very men rely on Rivett lathes and grinders when the closest precision limits must be maintained. In turn Rivett is proud of the part it has played in training master craftsmen and developing new products.

The first Rivett machine tools were made in 1884, and through the intervening years the builders have sought to perfect their every feature in pace with the progress of the times. Designing has been guided by wide and constant study of the usage in the field, and engineering has availed itself of new production methods and materials. Quality of workmanship has been protected by a group of skilled machinists and assemblers having life-long practice in the making and assembling of Rivett machines.

A proper and sound foundation of a machinist's training should include a knowledge of precision tolerances which can so well be taught on a Rivett machine.

Write for General Bulletin 500

RIVETT LATHE & GRINDER INC.
BRIGHTON, BOSTON, MASS.
PIONEERS IN BENCH LATHE DEVELOPMENT

(Continued from page 35A)

that I understood their language, their games, their sports, and that their disturbing problems were not alien to me. We could hold a common understanding through which I could be of some help. Within a short time several of the boys were no longer a menace to the peace of the school. Instead of disturbing others, they were too busy doing their own chores. By no means were they always treated with kid gloves, but accepted stern treatment whenever essential.

One afternoon while bidding the boys good-by it occurred to me that they should be encouraged to work with their minds while using their hands in performing new-found skills. Two days later the printer's devils sat around my desk and discussed the possibility of working on a group project. "What shall it be?" the boys asked. "A booklet," I suggested. "A booklet on the presidents of the United States of America."

Research began immediately and within a short time the copy was in. Again we put our heads together in the planning and designing. The booklet was to consist of 36 pages with a separate cover, page size 3½ by 5 in. The inside pages would be of coated stock, and printed in blue ink on a white background. The cover would be of white, ripple finish. On the back page would be an American flag in two colors. The inside would have a title page, an introductory page, and a separate page for each president, containing a birth-to-death account, with high lights of our chief executives' careers. The specifications were complete and approved and the boys were off with a determination most unusual for them in a classroom. Many months went by. The boys would set up two pages at a time, space out the lines, tie up and pull proofs, hold copy and proofread. For efficiency we printed two pages at a time on a 10 by 15 Chandler and Price hand-fed press. The task was large but the boys whittled it down until all the forms were printed, including the two-color cover. By this time the term had ended and the spring semester found our young publishers with a job of binding on their hands. This consisted of folding the sheets on a flat wooden board with 1-in. nails as guides, collating the nine different forms and cover in proper sequence. The book was wire-stitched and finally trimmed on three sides in the paper-cutting machine.

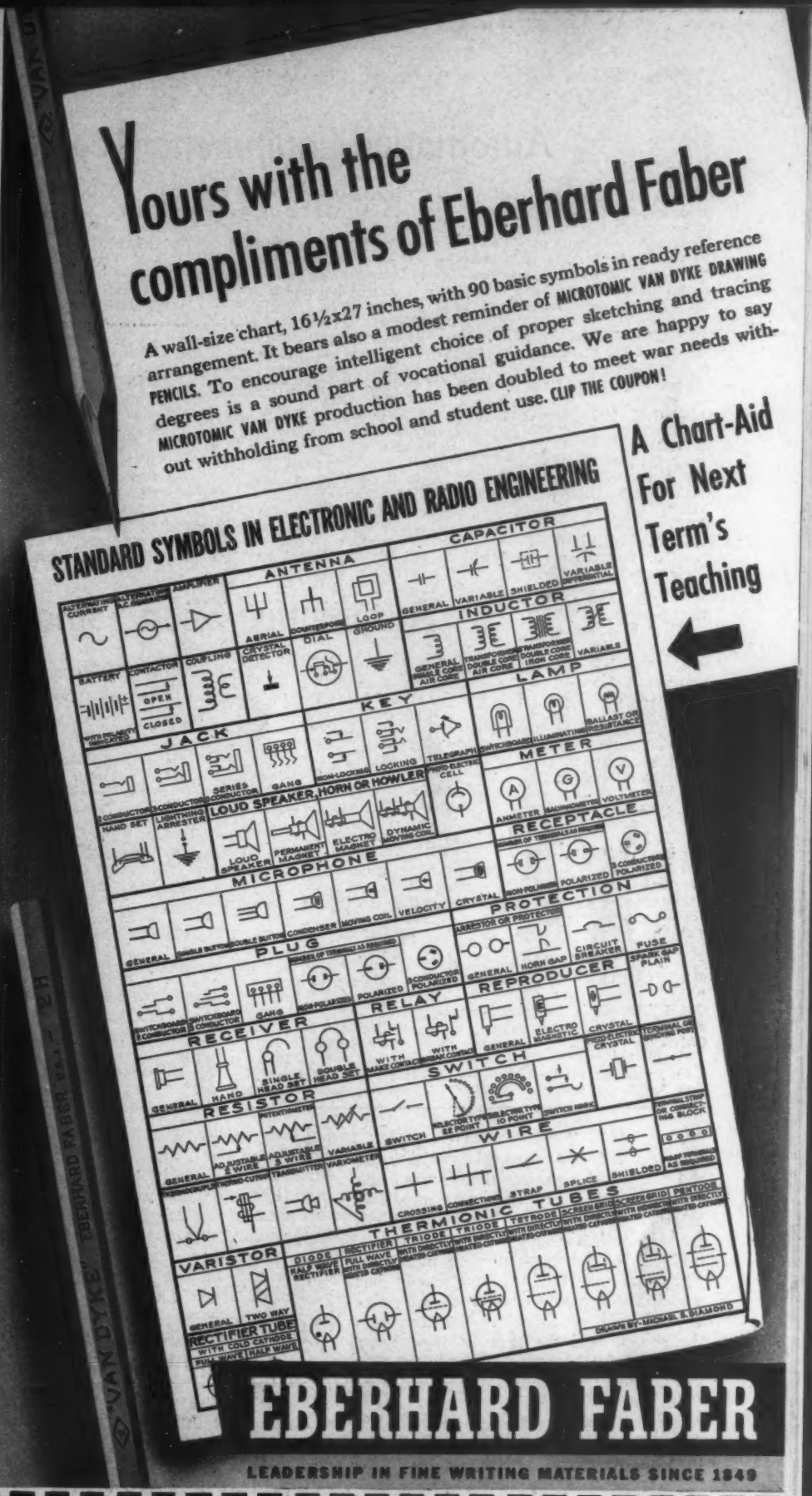
Was their job finished? What should we do with the booklets? We had to buy material which meant there would be a bill to pay. The next day the boys divided the school in zones and each solicited his area with the vim of a "Fuller Brush" man, and within a week's time they had sold a sufficient number of copies to more than cover the cost of their project. Enough money was left over to subsidize the printing of a school calendar.

(Continued on next page)

Yours with the compliments of Eberhard Faber

A wall-size chart, 16½x27 inches, with 90 basic symbols in ready reference arrangement. It bears also a modest reminder of MICROTOMIC VAN DYKE DRAWING PENCILS. To encourage intelligent choice of proper sketching and tracing degrees is a sound part of vocational guidance. We are happy to say MICROTOMIC VAN DYKE production has been doubled to meet war needs without withholding from school and student use. CLIP THE COUPON!

A Chart-Aid For Next Term's Teaching



EBERHARD FABER

LEADERSHIP IN FINE WRITING MATERIALS SINCE 1849

EBERHARD FABER PENCIL CO., Educational Dept. 1A-3, 37 Greenpoint Ave., Brooklyn 22, N. Y.
Please send me FREE your Wall Chart No. 4—"Electronic and Radio Symbols."

Name _____

School _____

Address _____ City _____

Detroit Public Library

Automotive Equipment, Tools, and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

AIR COMPRESSOR
- *a*) 3 to 4 cu. ft., with tank, piping, and motor
- *b*) Small portable, 1 cu. ft., with motor

ALIGNING JIG — for connecting rods

ANVIL
- *a*) No. 100 or No. 125
- *b*) Rim

ARMATURE GROWLER AND TESTER

AXLE STANDS

BATTERY EQUIPMENT
- *a*) Cell tester, panel type with discharge rack
- *b*) Charger (15-battery size) with rack
- *c*) Charger (6-battery size)
- *d*) Gas stove (small)
- *e*) Lead-burning torches, with gauges and piping
- *f*) Plate racks

BENCH
- *a*) Electric test, elaborate
- *b*) Electric test, simple
- *c*) Work, with vises
- *d*) Work, portable with vise

BLACKBOARD

BLOWTORCHES — 1-qt. size

BOOKCASE

BRAKE
- *a*) Adjusting stand
- *b*) Band-lining machine

BULLETIN BOARD

CABINETS
- *a*) Wood or metal, for bolts and supplies
- *b*) Wood or metal, for filing job sheets and correspondence

CHAIN HOIST — with overhead trolley and track

CHAIRS
- *a*) Teacher's
- *b*) For tables, or with tablet arms

CRANE — portable

CRANKSHAFT TRUING TOOL

CREEPERS

DESK — teacher's

DRILL
- *a*) Breast
- *b*) Hand
- *c*) Electric portable, 3/8 in.
- *d*) Electric portable, 1/4 in.
- *e*) Press, 21 in., with motor and chuck

DYNAMOMETER — electric

FORGE — with blower and tools

FURNACES — gas

GREASE DISPENSERS

GRINDER
- *a*) Cylinder with motor
- *b*) 8 in., with motor
- *c*) 12 in., with motor

HONES — cylinder

JACKS
- *a*) Lever, 1½-ton
- *b*) Floor, roller

LATHE
- *a*) 11 in. by 4 ft., with motor, chucks, and attachments
- *b*) 16 in. by 6 ft., with motor, chucks, and attachments

PRESS
- *a*) Arbor
- *b*) 30 ton

SPRAY PAINTING OUTFIT

VALVE REFACING MACHINE

VULCANIZER
- *a*) Electric steam for tube work
- *b*) Small, hand

WELDING OUTFIT — with tanks, gauges, and cutting torch

WHEEL ALIGNMENT
- *a*) Gauge
- *b*) Test table

Automotive Shop—Small Tools

ABRASIVE — rubstone for cleaning castings in foundry

ALCOHOL TESTER

BATTERY
- *a*) Cell tester, prod type
- *b*) Cell tester, cadmium
- *c*) Clips, large
- *d*) Element pullers
- *e*) Fillers
- *f*) Funnels, glass
- *g*) Hydrometer, acid
- *h*) Knives
- *j*) Post builders
- *k*) Post drills
- *l*) Post markers
- *m*) Separator trimmer

BITS
- *a*) Expansive
- *b*) Ratchet brace
- *c*) Wood, 3/16 in. to 1 in.

BOLT CUTTER — 24 in. and 36 in.

CALIPERS — 6 in. inside and outside

CANS
- *a*) Oil, 1/3 pt.
- *b*) 1 gal., gas, safety
- *c*) 5 gal., gas, safety
- *d*) 5 gal., kerosine
- *e*) Waste

CHECKS — tool, 1000, blank

CHISELS
- *a*) Cape, 3/8 in. and 5/8 in.
- *b*) Cold, 3/8 in., 5/8 in., 3/4 in., 1 in.
- *c*) Diamond point

COMBINATION SQUARES — 12 in.

COTTER-PIN EXTRACTOR

DIVIDERS — 6 in. and 10 in.

DRILL SETS
- *a*) 1/32 in. to 1/2 in., by 64ths
- *b*) 1/2 in. to 1 1/4 in., by 32nds

FILE CARDS

FILE HANDLES — assorted

FILES
- *a*) Flat bastard, 6 in., 8 in., 10 in., and 12 in.
- *b*) Half round, 6 in., 8 in., 10 in., and 12 in.
- *c*) Mill, 6 in., 8 in., 10 in., and 12 in.
- *d*) Round, 6 in., 8 in., 10 in., and 12 in.
- *e*) Square, 8 in., 10 in., and 12 in.

FIRE EXTINGUISHERS — Pyrene and Acid

FIRST-AID CABINET AND SUPPLIES

FLOOR BRUSHES — 18 in.

FUNNELS — tin, assorted sizes

GAUGES
- *a*) Air pressure
- *b*) Center
- *c*) Depth
- *d*) Thread
- *e*) Thickness

GLASS CUTTERS

GOGGLES

GREASE GUNS — plain and pressure type

HAMMERS
- *a*) Ball peen, 4 oz.
- *b*) Ball peen, 1 1/4 lb.
- *c*) Ball peen, 2 lb.
- *d*) Lead
- *e*) Riveting
- *f*) Sledge, No. 12

LADLE
- *a*) 3-in. bowl
- *b*) 6-in. bowl

LAMPS — extension, with reels

LEAD POT — gas

MAGNET CHARGER

METERS — volt and ammeter test

MICROMETERS
- *a*) Outside, 0 to 1 in.
- *b*) Outside, 2 in. to 3 in.
- *c*) Outside, 3 in. to 4 in.
- *d*) Inside, 1½ in. to 6 in.

MOLDS
- *a*) Battery nut
- *b*) Battery post
- *c*) Battery strap
- *d*) Burning stick
- *e*) Lead hammer

OILSTONE

PIPE TAPS — 3/8 in., 1/4 in., 3/8 in., and 1/2 in.

PLIERS
- *a*) Combination, 6 in.
- *b*) Flat nose
- *c*) Roundnose

PULLERS
- *a*) Bearing
- *b*) Gear
- *c*) Wheel, hub type

PUNCHES
- *a*) Center
- *b*) Taper pin
- *c*) Blacksmith

PUTTY KNIVES

(Continued on page 42A)

(Continued from previous page)

In less than two terms this special group had completed a project that covered history, English, art, layout, typesetting, proofreading, stonework, presswork, binding, and salesmanship.

Copies of the booklet were mailed to various places. We have on file in our school testimonial letters from the office of the President of the United States, from the governor of the state of New York, and from the Mayor of the city of New York.

Of this group four have gone on to vocational schools, two are apprenticed in industry, one has left, but as yet hasn't found himself, and the last one is carrying on alone for another term.

Finding something they liked in school improved their attendance, their behavior, and their studies. They began to recognize and respect the qualities essential in good citizenship and the benefits derived therefrom. Peace of mind was brought to worried parents who had previously despaired of their child's chances. The school rightfully assumed a responsibility and the graphic arts became a vehicle of accomplishment.

AIRPLANE SHEET-METAL SHOP PRACTICE

M. D. CAFFIN
Public Schools
Newark, N. J.

(Continued from page 430 of the December, 1943, issue)

Layout of Airplane Parts

Most airplane factories now use a photographic method of transferring the layout of parts from the full-size drawing to the sheet aluminum. This process has greatly reduced the amount of manual layout formerly required.

The lofted or full-size layout is photographed through a large camera, and a negative is made on glass. This negative is then projected full size onto sensitized sheet metal. A photograph of the layout full size is thus obtained on sheet metal.

The sheet metal is then cut and shaped, and holes drilled as indicated by the layout which has been imposed on it, and a template or pattern is made which can then be used in the fabrication of duplicate parts.

Blueprints for shop use are also made from the glass negative mentioned above. Since the metal template and the blueprint are both made from the same negative, there is little possibility for error creeping in. The blueprint can be enlarged or reduced in size as desired.

(Continued on page 44A)

Snap-on Tools

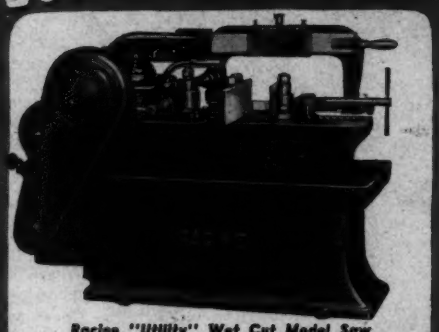
THE CHOICE OF BETTER MECHANICS

Progressive schools **long ago discarded the theory that, "It doesn't pay to invest in fine tools. You can't keep the boys from abusing them." Respect for good tools—and keen appreciation for the better, faster workmanship they deliver—is fundamental in training the prideful, productive craftsmen of the future. With war-time scarcities of good tool equipment it is now more than ever important to emphasize, "Use good tools . . .** ***and treat them right!***" **To vocational schools throughout America Snap-on's direct-to-user school service is available through 35 factory branches. Write for catalog of the complete Snap-on line.**

SNAP-ON TOOLS CORPORATION

8074-C 28th Avenue **Kenosha, Wisconsin**

All your metal cutting ON JUST ONE SAW



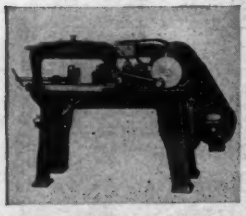
Racine "Utility" Wet Cut Model Saw
Capacity 6" x 6"

MAKE TRAINING SAFER, EASIER and FASTER

Racine "Utility" model metal cutting saws are the machines for use in vocational schools. They cut any metal from soft aluminum tubing to tough alloy steel. Modern in design and safeguarded throughout. They are used in the shops of modern industry, thus providing students with advantageous experience in modern metal cutting methods.

Racine "Utility" saws have hydraulic control of feed and pressure. This feature reduces blade breakage. It requires little or no attention and a minimum of servicing.

SIMPLE MECHANISM • HIGH EFFICIENCY • LOW IN PRICE



Racine "Utility" Dry Cut Model Saw—Capacity 6" x 6"

Equipped with the latest control devices, so simple that anyone can operate, these saws are the best dollar value on the market. A simple graduated dial controls the feed pressure—a small needle valve controls the rate of feed. This machine does your metal cutting fast, efficiently and with maximum safety. Write today for complete information and prices. Address Dept. IA-3. No obligation whatever.

FEATURES OF RACINE "UTILITY" SAWS

- **OIL HYDRAULIC FEED** — Provides accurate control of feed and pressure.
- **HYDRAULIC UNIT**— Simple, compact. Nothing to get out of order. Packless and leak-proof.
- **DRIVE** — Belts and chain drive completely guarded. Adjustable motor bracket.
- **VISE** — Quick acting — positive grip, for cutting any angle up to 45°.

(Continued from page 40A)

REAMER — spindle bolt
REAMER SETS
- *a*) Piston pin, ⅛ in. to 1⅜ in.
- *b*) Taper pin
- *c*) Valve seat

SAWS
- *a*) Hack, frames, 10 in., adjustable
- *b*) Hack-saw blades, 18, 20, and 24 teeth
- *c*) Hand

SCALES
- *a*) Steel, 6 in., graduated 1/64 and 1/100 in.
- *b*) Steel, 12 in., graduated 1/32 in.

SCRAPERS
- *a*) Bearing
- *b*) Carbon

SCREW DRIVERS
- *a*) 6 in. and 12 in.
- *b*) Small combination

SCREW EXTRACTORS
SCRIBERS
SNIPS — tin, 3 in. straight and 3 in. curved
SOLDERING COPPERS — 1, 2, and 3 lb. with handles
SPRING SPREADERS
STAMPS
- *a*) Figures, 3/16 in.
- *b*) Letters, 3/16 in.

TAP-AND-DIE SETS
- *a*) Machine screw
- *b*) N.F. ¼ in. to 1 in.
- *c*) N.C. ¼ in. to 1 in.

TIRE TOOLS
TOOL KIT — metal box or canvas roll, empty
TWIST DRILLS — (extra sets) selected sizes
VALVE
- *a*) Grinders (hand)
- *b*) Spring lifters

WRENCHES
- *a*) 8 in., 10 in., 12 in., and 18 in.
- *b*) Ignition sets
- *c*) Pipe, 10 in., 14 in., 16 in., and 18 in.
- *d*) Rim socket
- *e*) Socket sets, large assortment with case
- *f*) Spark plug
- *g*) Speed wrenches
- *h*) Standard end sets, ¼ in. to ⅞ in., N.C. and N.F.
- *i*) Valve-tappet wrenches

Automotive Shop— Materials and Supplies

ACETYLENE GAS — in drums, for welding
ACID
ALCOHOL
BABBITT
BEARING BLUE
BEARING COMPOUND
BOLTS
- *a*) Machine, selected sizes
- *b*) N.F., selected sizes
- *c*) Stove, flat or round heads, selected sizes

BRAKE JUICE — ½-pt. cans
BRUSHES
- *a*) Paint
- *b*) Spark plug
- *c*) Spoke
- *d*) Steel
- *e*) Varnish

CHAMOIS
COIL-SPRING ASSORTMENT
COPPER TUBING
COTTER PINS — assorted sizes
CROCUS CLOTH
DISTILLED WATER
DRAIN COCKS
ELECTROLYTE
EMERY CLOTH — Nos. 2/0, 0, ½, and 1
ENAMEL — AUTO PAINTING
GASKETS
- *a*) Copper asbestos
- *b*) Cork and felt
- *c*) Flange

GASOLINE
GREASE — cup, cans
KEROSINE
KEYS, WHITNEY — assorted
LACQUER — colors
LEAD
LUBRICANT — transmission
NAILS AND BRADS
NUTS
- *a*) N.F., castellated, square, hexagon, selected sizes and kinds
- *b*) N.C., square and hexagon, selected sizes
- *c*) Machine screw, selected sizes
- *d*) Wing, selected sizes

OIL
- *a*) Cylinder, light, medium, and heavy
- *b*) 600W
- *c*) Penetrating

OXYGEN — in drums for lead burning
PIG LEAD
PISTON-RING COMPRESSORS
RADIATOR HOSE
RIVETS — brake lining, 5/16 in., ½ in., and ¾ in. long.
SANDPAPER — Nos. 2/0, 0, ½, and 1
SCREWS
- *a*) Flathead or roundhead, iron or brass, selected sizes and kinds
- *b*) Cap and machine, iron, or brass, selected sizes and kinds

SEALING COMPOUND
SHELLAC — ½-pt. cans
SHIM STOCK
SOAPSTONE
SOLDER — bar, wire, or self-fluxing wire
SOLDERING PASTE
SPELTER — for brazing
SPONGES — ½ lb.
STARTING CABLE
TACKS AND STAPLES — upholstery
TIRE
- *a*) Carcass fabric
- *b*) Cushion stock
- *c*) Inner-tube repair stock
- *d*) Patching cement
- *e*) Patches
- *f*) Putty
- *g*) Tread stock
- *h*) Vulcanizing

VALVE-GRINDING COMPOUND — coarse and fine
WASHERS
- *a*) Lock, assorted sizes
- *b*) Wrought iron

WASTE
WIRE — primary and secondary

Hands that Command the Nation

THE TECHNICAL KNOWLEDGE, the ingenuity and the resources of America are at the disposal of our skilled medical officers on the fighting fronts of the world. They command every aid the nation can supply. That is one reason why a wounded man's chances of survival are greater today than they have been in any other war.

Among the materials that are helping medical men in their fight to save lives are the *stainless steels*. Used in operating tables, surgical instruments and in other medical equipment, stainless steels are serving in hospitals in this country and overseas.

Frequent sterilization with high temperature steam or strong disinfectants will not injure stainless steels. Their smooth, hard surface is easily kept free from germs that can cause fatal infection. Even in the damp tropics, stainless steels do not rust. Tough and durable, free from the possibility of chipping, stainless steels can withstand the rigors of wartime use.

On the home front, too, stainless steels are making their contribution to the health of the nation. Because they are easier to clean and keep clean than other metals, they are widely used in equipment necessary to the processing, preparing and serving of foods. They keep their bright finish, impart no flavor to food, and resist food chemicals. They will be used increasingly in restaurants, in the home, and in many industries where their unique properties are so desirable.

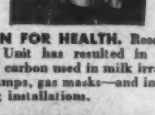
Stainless steels are "stainless" because they contain more than 12 per cent chromium. Low-carbon ferrochromium, a research development of ELECTRO METALLURGICAL COMPANY, a Unit of UCC, is the essential ingredient in the large-scale production of stainless steel. Units of UCC do not make steel of any kind. They do make available to steelmakers many alloys which, like ferrochromium, improve the quality of steel. The basic research of these Units means useful new metallurgical information—and better metals to supply the needs and improve the welfare of mankind.

▼

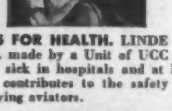
Members of the medical profession, architects and designers are invited to send for booklet K-3, "THE USE OF STAINLESS STEELS IN HOSPITALS." *There is no obligation.*

CARBON FOR HEALTH. Research by a UCC Unit has resulted in different forms of carbon used in milk irradiators, "sun" lamps, gas masks—and in air conditioning installations.

GASES FOR HEALTH. LINDE oxygen U.S.P. made by a Unit of UCC is used by the sick in hospitals and at home—and it contributes to the safety of our high flying aviators.



CHEMICALS FOR HEALTH. Synthetic organic chemicals, developed by a Unit of UCC, mean better anesthetics, more plentiful sulfa drugs, vitamins and other pharmaceuticals.



PLASTICS FOR HEALTH. BAKELITE and VINYLITE plastics, produced by UCC Units, mean sanitary paints, floor coverings, sheeting, "burn sleeves" and other essentials.

BUY UNITED STATES WAR BONDS AND STAMPS

UNION CARBIDE AND CARBON CORPORATION

30 East 42nd Street UCC New York 17, N. Y.

Principal Units in the United States and their Products

ALLOYS AND METALS
Electro Metallurgical Company
Haynes Stellite Company
United States Vanadium Corporation

CHEMICALS
Carbide and Carbon Chemicals Corporation

ELECTRODES, CARBONS AND BATTERIES
National Carbon Company, Inc.

INDUSTRIAL GASES AND CARBIDE
The Linde Air Products Company
The Oxweld Railroad Service Company
The Prest-O-Lite Company, Inc.

PLASTICS
Bakelite Corporation
Plastics Division of Carbide and Carbon Chemicals Corporation

(Continued from page 40A)

Layout essentials for the aircraft worker: In addition to the layout involved in the layout and spacing of holes for rivets, some essentials are listed which the skilled aircraft worker should know.

Direction of grain in sheet metal: Grain in sheet metal is formed by the compression of the molecules under the pressure of the rolls in the rolling mill where the sheet metal is produced. The grain usually runs lengthwise in the sheet, that is, the rolls extend across the width of the sheet, causing the grain to run the length of the sheet metal. Close examination of sheet aluminum alloy will show the grain lines. However, when it is not readily seen as in pure aluminum (2_s), a little nitrate dope thinner wiped on the sheet brings out the fine lines.

It is important to know the direction of the grain in laying out parts, for a bend made with the grain will not have the strength of a bend made against the grain. When the direction of the grain is important on a particular job, however, the print is marked with arrows to indicate its direction.

The direction of the grain of a sheet of metal used on a fuselage should be the same as the length of the fuselage, or longitudinal. On wings and control surfaces such as ailerons, fins, etc., the grain should run laterally, that is, from tip to tip.

It is always important to observe the direction of the grain in bending parts in order to obtain greater strength and to prevent cracking of the bend.

Use of templates: When using a template to lay out a part to be fabricated, both template and the metal on which the template is to be used should be clamped together firmly. The aluminum should be protected from the jaws of the clamp.

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

322 N. Francisco Ave., Chicago 12, U. S. A.

Eastern Warehouse and Sales Office: 199 Lafayette St., N. Y.

If a transfer punch is used to transfer the location of the template holes to the part being fabricated, the punching should be done lightly. It is best to back up the work with another piece of metal in order to avoid "dimpling." This results from heavy prick-punching, or improper backing up. It leaves a small hollow or concave area around the prick-punch mark which usually is not removed when the hole is drilled.

Incorrect prick-punching will also result in *oilcans.* This comes about when a piece is stretched on one side, and produces a buckle in the part being fabricated. *Oilcans* are very difficult to remove. The term is derived from the action when using an oilcan, and the effect is very similar when a part with many holes to be laid out is prick-punched heavily.

A scriber may be used to mark outlines only. Scriber marks must never appear on a finished part; however, the scriber may be used where the mark will later be cut off. When a part is scribed, a fine scratch is put on it. This scratch may later develop into a break when the metal is put under strain. Also, scribing cuts through the surface of the metal and makes it more liable to corrosion.

Use and handling of parts to be laid out: Since aluminum mars easily, it must be carefully handled. All sheet aluminum should be laid on clean, smooth surfaces only. Soft vise jaws should be used, and all metal chips removed before gripping aluminum. In airplane work, scratched, nicked, or dented aluminum is good only for scrap.

Accuracy: Accuracy to 1/64 in. is required of the aircraft worker, and in some instances tolerances are held finer.

Drilling holes: The portable electric or pneumatic drill is an indispensable tool to the aircraft worker. The drill is usually small since few holes larger than ¼ in. are required in airplane assemblies.

The following are brief statements giving the essentials which the aircraft worker must know and master.

1. Check to see that proper clearance is allowed before drilling the hole. Clearance is allowance made for the upsetting of the rivet which is to be placed in the drilled hole. (See page 429 in the December, 1943, issue of this magazine for details.)

2. Drill marks on the surface of a piece indicate poor drilling. Hold the portable drill firmly, and see that the work is securely fastened. Do not hold sheet metal by hand when drilling in the drill press.

3. A sharp drill will cut its own way through the metal. Do not force the drill. Forcing the drill causes burrs that are difficult to remove.

4. Drill all holes at right angles to the surface. Hold the drill motor at right angles to the surface to accomplish this.

5. When drilling thin aluminum sheet, it should be supported; that is, backed up from the back. A bucking bar held next to the spot where the drill will emerge is helpful.

6. All drilled holes must be burred before riveting. In the case of drilling two or more parts together, it is necessary to disassemble all parts and remove the burrs.

7. Care must be used not to countersink the hole in removing burrs. Holes are countersunk only to receive countersunk rivets.

8. Holes may be burred with a slightly larger size drill held in the hand. A light twist of the drill is usually sufficient. When many holes are to be burred, the drill may be placed in a small holder or handle. Small

(Continued on page 46A)

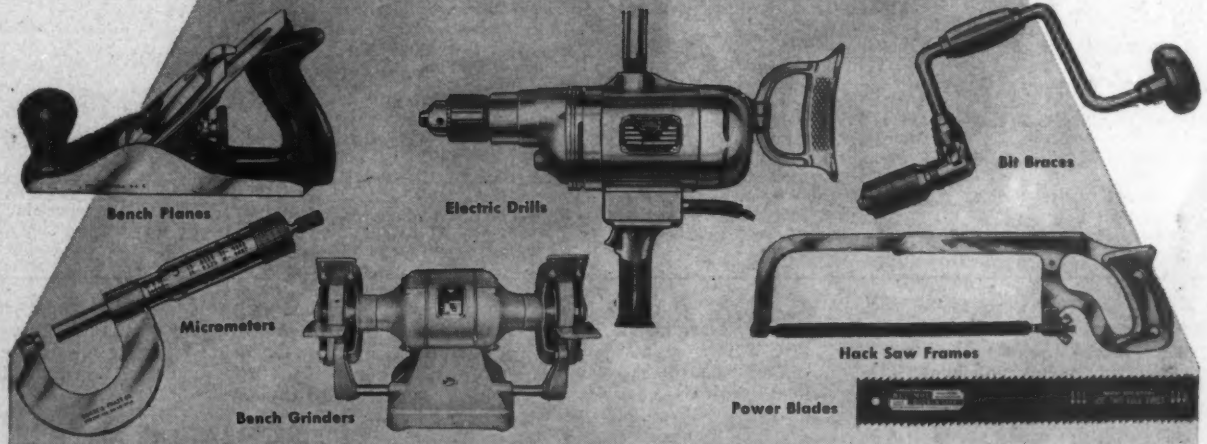
MILLERS FALLS TOOLS

SINCE 1868

THE JOBS AHEAD

VICTORY! That's our job for the duration. Millers Falls Tools have a thousand wartime tasks. They meet the need for tools to build bombers, tanks, ships, other weapons . . . tools for maintenance, at home and on the battle fronts . . . tools that can "take it" on the really tough jobs . . . tools that can deliver extreme precision. Almost anywhere that there's a wartime job, Millers Falls Tools are *on* the job.

PEACE! That job will be even bigger. There will be the demand for Millers Falls Tools to build more and better homes — tools for re-conversion of factories — tools for the needs of an increasingly mechanized America. Tools for the colossal task of world-wide reconstruction. Millers Falls Tools will be ready for the tasks of Peace. Increased facilities will produce even finer tools, in the quantities needed.



MILLERS FALLS COMPANY • GREENFIELD, MASS., U. S. A.

Electrical-Shop Equipment, Supplies, and Motor and Testing Equipment

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

BENCH GRINDER
BENCHES — plain or with drawers, for tools and equipment, or with compartments for the storing of wiring panels. Preferably they should have electrical outlets
BITS
- *a*) Auger, ¼ in. to 1 in. by 16ths
- *b*) Auger, 11/16 in., 18 in. long
- *c*) Drill, for wood, square shank, ⅛ in. to ½ in. by 16ths
- *d*) Expansion
- *e*) Extension, 18 in.
- *f*) Screw driver, ¼ in.

BLACKBOARD — permanent or portable
BLOWTORCHES — 1-qt. size
BOOKCASE
BRACES — ratchet type, 8-in. swing
BULLETIN BOARD
CABINETS — wood or metal for filing class records, instruction sheets, drawings, etc.
CHAIRS — teacher's and tablet arm
COMPASS SAW
COIL
- *a*) Spreader
- *b*) Taper
- *c*) Winder

DESK — teacher's, with drawer compartments
DRILL
- *a*) Breast
- *b*) Concrete, ⅜ in., ½ in., ¾ in., 1 in.
- *c*) Hand
- *d*) Portable, electric
- *e*) Twist, 1/32 in. to ⅜ in. by 32nds

DRILL PRESS
- *a*) Bench, hand, or power driven
- *b*) Heavy, power driven

FILES
FIRST-AID CABINET AND SUPPLIES
HACK SAW
- *a*) Blades, 10 in., 24 tooth
- *b*) Frames, adjustable

HAMMERS
- *a*) Claw, 12 oz.
- *b*) Machinist's, ball peen

HICKEY — ½ in. and ¾ in.
LATHE
- *a*) Engine, 10-in. or 12-in. swing, 6 ft. or 8 ft. long
- *b*) Speed

PLIERS
- *a*) Gas, 6½ in. and 8 in.
- *b*) Side cutting, 6 in.

PUNCH — for metal molding
PUNCHES — assorted
REAMERS
- *a*) Pipe burring, ¼ in. to 1 in.
- *b*) Pipe burring, ½ in. to 2 in.

RULES
- *a*) 48 in. zigzag
- *b*) 72 in. zigzag

SCREW DRIVERS — 3 in., 5 in., and 8 in.
SHEARS — for cutting metal molding
SOLDER DIPPERS
SOLDERING COPPERS
- *a*) Assorted
- *b*) Electric
- *c*) Handles

STOCKS AND DIES — for pipe threads, ½ in. to 1 in.
VISES
- *a*) Machinist's, 4 in.
- *b*) Pipe

WRENCHES
- *a*) Adjustable, 6 in. and 8 in.
- *b*) Pipe, 10 in., 12 in., and 14 in.
- *c*) Socket, combination

Electrical Shop—Supplies

ABRASIVE CLOTH — Aluminum oxide, 1, 1½, and 2 in. wide
ARMORED CABLE
- *a*) 2 wire, No. 14, single strip
- *b*) 3 wire, No. 14, single strip
- *c*) Box connectors

ATTACHMENT PLUG
BAR HANGERS
BATTERIES — dry cells
BATTERY ACID — 1.300
BATTERY SEALING COMPOUND
BOX CLEATS
BRADS — ¾ in., No. 19, and 1½ in., No. 16
BRAKE LINING — ¼ by 2 in.
BRUSHES — carbon, for motors and generators
BURGLAR CONTACTS
- *a*) Open circuit
- *b*) Closed circuit

BUSHINGS
- *a*) Loom, No. 1 and No. 2
- *b*) "Jiffy" loom No. 2

BUZZERS
CLEATS — unglazed porcelain, 2 wire
CLIPS — test, with insulators, Universal, Nos. 22, 23, 24, and 25
COMMUTATOR CEMENT
CONDUIT
- *a*) Bushings, ½ in., ¾ in., and 1 in.
- *b*) Box connectors, for flexible
- *c*) Couplings, for flexible
- *d*) Lock nuts, ½ in., ¾ in., and 1 in.
- *e*) Rigid, ½ in., ¾ in., and 1 in.

CONDULET
- *a*) Fillings, ½ in., LL, LR, and LB
- *b*) Covers, ½ in., blank

DOOR OPENERS — mortised
FISH PAPER — .0125 in. thick
FIXTURES — brass chain, suspension
FIXTURE STUDS
FUSES
- *a*) Plug type, renewable, 125 volt, 15 amp.
- *b*) Cartridge type, renewable, 125 volt, 30 amp.
- *c*) Renewals for plug fuses
- *d*) Renewals for cartridge fuses

GROUND CLAMPS — ⅜ in. to 1 in., assorted
HICKEY GRIPS — ½ in. and ¾ in.
LAMPS
- *a*) Carbon, 220 volt, 60 watt
- *b*) Mazda, selected as wattages and voltages
- *c*) Guards for brass sockets

LEATHER NAIL HEADS
LUGS — 25 and 50 amp.
LUMBER — 2 by 4 in. by 14 ft., No. 1, white pine dressed, 4 sides
MOLDING
- *a*) Metal
- *b*) Metal, fittings — crosses, T's, internal elbows, junction boxes, switch bases, keyless receptacles, snap switches

NAILS — roofing
NUTS — iron, 4–36, 6–32, 8–32, 10–24, 12–24, 10–32, 14–20
OUTLET BOXES — 4 in. square, with one round blank cover, and one cover with bushed opening
PIPE STRAPS — galvanized, ⅜ in., ½ in., ¾ in., and 1 in.
PUSH BUTTONS
- *a*) Return call, 3 point
- *b*) Single

RECEPTACLES
- *a*) Flush, duplex
- *b*) Porcelain cleat, 660 watt, 250 volt
- *c*) Concealed
- *d*) Covers

RECTIFIERS — Tungar, for charging from 1 to 12, 6- and 12-volt batteries
RELAYS — Dixie
RESISTANCE BOARDS — for testing
RESISTANCE UNITS — 125-ohm
RHEOSTATS
- *a*) Compression, 275 watt
- *b*) Field, for shunt and compound motors

ROSETTES — wood
ROTARY CONVERTER — 5-kw. capacity, 3 phase a.c., 110 volt d.c.
SCREWS
- *a*) Anchors, 8/32, 10/24, 12/24, 14/20
- *b*) Machine, roundhead, 4–36 by ¼ in., 6–32 by ½ in., 6–32 by ¾ in., 8–32 by ⅜ in., 8–32 by ½ in., 8–32 by 1 in., 10–32 by ⅜ in., 10–24 by ⅜ in., 10–24 by ¾ in., 10–32 by ¾ in., 12–24 by 1 in.
- *c*) Machine, brass, roundhead, 4–36 by ¼ in., 6–32 by ½ in., 6–32 by ¾ in., 8–32 by ½ in.
- *d*) Wood, flathead bright, No. 5 by ¾ in., No. 8 by ½ in., No. 8 by ¾ in., No. 8 by 1 in., No. 7 by 1½ in., No. 8 by 1½ in., No. 7 by 2 in.
- *e*) Wood, roundhead blued, No. 7 by 1 in., No. 8 by 1½ in., No. 10 by 1½ in., No. 7 by 2 in.

SLEEVING — No. 1, white; No. 1, blue; and No. 1, red
SOCKETS
- *a*) Brushed, brass pull chain, keyless, key
- *b*) Porcelain, keyless, with caps
- *c*) Porcelain, key, with caps

SOCKET CAPS — ¼ in. and ⅜ in. bushed
SOLDER WIRE — 50/50, size No. 10
SOLDERING PASTE — 2-oz. cans, noncorrosive
SOLDERING SALTS — 1-oz. cans, noncorrosive
SPEED COUNTERS — 0–9999
SPLIT KNOBS — porcelain
SPRING BALANCES — 0–30 lb.

(Continued on page 48A)

(Continued from page 44A)

file handles are sometimes used for this purpose. Inspect burred holes to be sure that the edges have not been countersunk.

9. Care must be exercised not to damage parts attached to the inside of an assembly that is being drilled. Control the drill so that it breaks through lightly and does not enter the hole more than ⅛ in.

10. Holes larger than ⅛ in. in diameter must first be pilot drilled. A drill ⅛ in. or smaller may be used for piloting a hole. Experience is required to be able to drill round holes in sheet metal. The beginner will find that it is very easy to produce triangular shaped holes in sheet metal, when using a round drill. Use of a pilot drill, holding work securely, and drilling lightly is helpful in avoiding triangular shaped holes.

11. Drilled holes are inspected for the following: correct size hole; roundness; lack of burrs; smooth wall edges; accurate placement of drilled hole.

12. Prick-punch before drilling, and check for accuracy of location after pilot drilling. It is possible to correct small deviations found in the pilot hold by bearing toward the place where the hole should be, when the hole is drilled to final size.

COMBATING JUVENILE DELINQUENCY

The city of Detroit, Mich., has "Youth Expediters" who represent the board of edu-

(Continued on page 51A)

GENERAL ELECTRIC EDUCATIONAL SERVICE

Because of the utilization of our facilities for war work, the War Production Board priority requirements may make it impossible for us to make the deliveries you desire. However, there are no priorities on plans for your future needs.

Laboratory Apparatus

General Electric engineers will gladly recommend apparatus to meet your special conditions if you will give them such details as: type of course, number of students, laboratory or shop space available, money at hand for equipment, etc. Further than this, liberal discounts from the regular commercial prices of Company products are allowed to educational institutions. For quotations on apparatus and further information concerning G-E educational service, consult the Educational Specialist at the nearest office of the Company, or write direct to our Educational Sales Section at Schenectady.

Usually, the General Electric Company recommends standard apparatus for laboratory instruction. It is recognized, however, that because of its size, cost, and the power required for operation, much commercial apparatus cannot be used in the laboratories of engineering schools and colleges. For this reason, the General Electric Company has given especial attention to the selection for educational use of such standard apparatus as is of suitable size and which will illustrate fundamental principles of design and construction as well as acceptable commercial practice.

Where standard apparatus is not entirely suitable, the General Electric Company has not hesitated to design special apparatus for the electrical laboratory and shop.

Thus the student is given an opportunity, while becoming familiar with the underlying principles of electrical engineering, to become acquainted with actual construction details. Bulletin GEA-1185, illustrates and describes G-E apparatus particularly adapted for laboratory use.

Electrical Laboratory and Shop Equipment

When deciding on the equipment for an electrical shop or laboratory, Bulletin GEB-62 will be particularly useful. In this booklet will be found equipment to meet a wide range of requirements. For the elementary courses, a few of the more important types of machines are recommended, together with control apparatus, measuring instruments, and certain machine tools which should be in every electrical shop. For more advanced work, or as funds become available, equipment from other groups may be added to provide well-balanced laboratory equipment which will permit a wide range of experiments.

In addition to listing the equipment, this booklet discusses briefly the several items, explaining why they have been selected and the use to which they may be put in the laboratory.

Photo News Service

General Electric furnishes more than 10,000 school and college teachers in this country and abroad with semimonthly news posters which tell briefly, authoritatively, and interestingly the story of the accomplishments of electricity — the most recent developments in the research laboratories of the Company — experiments with man-made lightning — electric ships, spectacular lightning, precision instruments, short-wave radio, X ray. These posters have come to be almost standard equipment for many general-science teachers. They are published on the 1st and 15th of every month from October 1 through June 15. The service is free. Teachers only should apply for it, and should give their school address.

Motion-picture Films

An extensive motion-picture service is maintained by the General Electric Company for the purpose of disseminating throughout the United States reliable information concerning important developments in the electrical field.

The service provides motion-picture films by means of which the details of manufacture and the use of electric products are presented in a highly instructive manner.

Silent pictures are furnished either in 35-mm, safety or nitrate stock, and 16-mm safety stock.

All sound pictures are available in 16-mm sound on film, safety base. Many are also available in 35-mm size. Films are lent free of charge with transportation charges paid by user.

These films are listed and described in General Electric's motion-picture catalog, GES-402, copies of which may be had upon application to the nearest G-E office. Requests for the use of motion-picture films should be addressed as directed in that publication and will receive the attention of a specialist.

Educational Construction Projects

The General Electric Company, in carrying out its educational program, has sponsored the preparation and publication of several construction projects for technical and vocational schools. These projects are exceptionally valuable for the school shop since they are not merely assembly projects, but involve a certain amount of mechanical dexterity with such tools as the lathe, drill press, tap and die, etc. The G-E projects have the following standard ratings and are completely described in the G-E bulletins indicated:

(1) ¼-hp, single-phase, 60-cycle, 110-volt capacitor-motor, GEA-3514.

(2) ½-hp, single-phase, 60-cycle, 115/230-volt capacitor-motor, GEA-3526.

(3) ½-hp, 3-phase, 60-cycle, 220-volt motor, GEA-3542.

(4) 250-watt, 125-volt, compound-wound d-c generator, GEA-2289.

(5) 1½-kva, 220-55/110-volt, 60-cycle air-cooled transformer, GET-569.

Other G-E Publications

Catalogs, descriptive bulletins, and other publications are available covering practically all standard lines of G-E apparatus, such as electric motors, controls, instruments, transformers, etc. For such bulletins and for complete information regarding any electric equipment in which you are interested, address the Educational Specialist at the nearest G-E office.

GENERAL ELECTRIC

General Office, Schenectady, N. Y. — Sales Offices in Principal Cities

Standard Practice in Industry

Photo Courtesy Pan-American World Airways

Make

KESTER SOLDERS

Your School Shop Standard, too

• Kester Flux-Filled Solders have won their high place in industry with the dependable quality of both flux and alloy — quality that gets *permanent* results, that stands up under temperature extremes, vibration, bending and shock. That makes them best for instruction in the school shop, too!

• Soldering with Kester Flux-Filled Solders is easily taught, quickly learned. Flux and alloy, both in proper amount, are applied in *one single operation* — no messy separate flux to spatter benches or mar floors in your schoolroom.

• Solderers are in demand in war industry; there'll be many good jobs in that field after the war. Teach your students to solder the KESTER way — it's a skill they'll find permanently valuable, whether they actually work at it or practice it at home in their hobbies and for making miscellaneous repairs.

• Your students — and you — will be proud of the fine soldering they'll do with Kester Flux-Filled Solders. Their skill will be a credit to you. Make Kester Flux-Filled Solders your shop standard! Order from your wholesaler.

★ BUY WAR BONDS ★

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Eastern Plant - - Newark, N. J.

Canadian Plant - Brantford, Ont.

Finest Quality FOR 45 YEARS 1899-1944 KESTER SOLDER

KESTER

FLUX-FILLED SOLDER

(Continued from page 46A)

STARTING BOXES
- a) For compound motors, various makes
- b) For shunt wound, 1 h.p., 110-volt motors. Overload release
- c) For shunt wound, 1 h.p., 110-volt motors. No voltage release
- d) Starting devices of various makes and principles, for 1 h.p., 3-phase, 220-volt a.c. motors

STORAGE BATTERIES — 6 volt

SWITCH
- a) Battery, 4 point
- b) Bases, porcelain, for 10-amp. switches
- c) Boxes, 2¾ in. deep
- d) Entrance, safety, 2 pole, 30 amp., with 2-branch lighting circuits
- e) Entrance, safety, 3 pole, 30 amp., 250 volt
- f) Flush, push button, S.P., D.P., 3 way, 4 way
- g) Surface, S1, S3, and S4
- h) Knife, type A, D.P.S.T., D.P.D.T., S.P.S.T., and S.P.D.T.
- i) Surface, snap, electrolier
- k) Surface, snap, S.P.D.P., 3 way, 4 way

SWITCHBOARD — as required

TACKS — double-pointed No. 10

TAPE
- a) Friction, ½-lb. rolls
- b) Rubber, ½-lb. rolls

TELEGRAPH SETS — including sounders, keys, and relays

TELEPHONES
- a) Complete bridging, independent phones
- b) Couch vestibule telephones
- c) Receivers, transmitters, induction coils, condensers, and bridging switch hooks

TRANSFORMERS
- a) Bell ringing, 6, 8, 14 volt
- b) Single phase, 110–220 volt, S.K.V.A.

TUBES — porcelain, 5/16 by 3 in., 5/16 by 5 in., and 5/16 by 10 in.

TUBING — flexible nonmetallic, ¼ in. and ⅜ in.

WASHERS
- a) Iron, ¼ in. and ⅜ in.
- b) Brass, ¼ in. and ⅜ in.

WIRE
- a) Annunciator No. 18 or No. 20
- b) Fixture, No. 18, single yellow, with marker
- c) Rubber covered, solid copper, No. 10, black
- d) No. 10, white
- e) No. 14, black
- f) No. 14, white
- g) Rubber covered, No. 16, brewery cord
- h) No. 18, lamp cord, green and yellow
- i) S.C.C. copper magnet, enameled, sizes Nos. 16 to 26 inclusive

Electrical Shop— Motor and Testing Equipment

ANNUNCIATORS
- a) Automatic needle drop
- b) Gravity drop
- c) Manual needle drop

ARMATURES — burnt out, for repairing

BATTERY CHARGER — commercial

CIRCUIT BREAKERS
- a) Air, single pole, overload, 25 amp., 550 volt
- b) Air, single pole, underload, 15 amp., 550 volt

CONTROLLERS
- a) For multiple-speed motor
- b) For 1 h.p., 110-volt series motors

GENERATORS
- a) Motor-generator set, 10 h.p., to supply 110-volt d.c. for testing purposes, battery charging, etc.
- b) Generator, 6-volt d.c. coupled to an a.c. motor for 6-volt circuit testing
- c) Auto generators of different makes

GRAVITY CELLS

MAGNETS — testing, 10,000 ohm

METERS
- a) Ammeter, standard, 60 amp., a.c.
- b) Ammeter, standard, 60 amp., d.c.
- c) Ammeter, student, 60 amp., a.c.
- d) Ammeter, student, 60 amp., d.c.
- e) Voltmeter, standard, 0–10 volt,
- f) Voltmeter, standard, 110–220 volt, d.c.–a.c.
- g) Voltmeter, standard, 125 volt, a.c.
- h) Voltmeter, standard, 125 volt, d.c.
- i) Voltmeter, student, 110 volt, d.c.
- k) Voltmeter, student, 110 volt, a.c.
- l) Wattmeter, standard, 110–220 volt, 30–60 amp., d.c.–a.c.
- m) Wattmeter, student, 110–220 volt, 30 amp., a.c.–d.c.
- n) Watt-hour meter, 125 volt, 5 amp., a.c., single phase, various makes

MOTORS
- a) Auto starter, different makes
- b) Burnt out, fractional h.p., 110 volt, 60 cycle, for repairing
- c) Compound, 1 h.p., 110 volt, d.c.
- d) Multiple speed, 1 h.p., 3 phase, 220 volt
- e) Series, 1 h.p., 110 volt, d.c.
- f) Shunt, 1 h.p., 110 volt, d.c.
- g) Split phase and repulsive, a.c., 110 volt, single phase, assorted
- h) Split phase induction motors, fractional h.p., 110 volt, 60 cycle, different makes
- i) 3 phase, 1 h.p., a.c., 220 volt, various makes
- k) 3 phase, 2 h.p., 220 volt, a.c., various makes
- l) Universal, fractional h.p., 110 volt, different makes
- m) Universal, variable speed, ½ h.p.

PLATFORM SCALE — 100 lb. capacity

The World's STANDARDS OF ACCURACY

for Instruction, Research, Industry

The widespread use of WESTON instruments in vocational education has become a fixed principle...primarily because these are the measurement standards so widely used throughout industry. Thus the student becomes thoroughly familiar with the instruments he will use throughout his industrial career. They are preferred, too, because they inspire students to be more exacting in their work, and because they represent a truly sound investment...combining ruggedness, dependability and long life.

Following is a condensed listing of the WESTON instruments available . . . also are illustrated a few of the models most widely used in educational work. Complete information on any WESTON instrument is available and will gladly be sent on request. Write to... Weston Electrical Instrument Corporation, 595 Frelinghuysen Avenue, Newark, New Jersey.

PORTABLE INDICATING INSTRUMENTS
Ammeters, Voltmeters, Wattmeters, Galvanometers, Microammeters, Ohmmeters, Microfarad Meters

PANEL MOUNTING INSTRUMENTS
Ammeters, Voltmeters, Wattmeters, Galvanometers, Microammeters, Ohmmeters, Microfarad Meters

RELAYS
Sensitive and Power Uses – Current and Voltage Types

INSTRUMENT TRANSFORMERS
Portable and Switchboard – Potential and Current

AIRCRAFT INSTRUMENTS
Tachometers, Temperature Indicators, Radio Compass Indicators, Ammeters, Voltmeters, etc.

ELECTRIC TACHOMETERS
A.C. and D.C. Types – Remote Indicating

LABORATORY STANDARDS
Voltmeters, Ammeters, Wattmeters

SPECIALIZED TESTING EQUIPMENT
Power Analyzer, Photoelectric Potentiometer, Battery Testing Instruments

SERVICE EQUIPMENT
Tubecheckers, Analyzers, Oscillators, Ohmmeters, Vacuum Tube Voltmeters

PHOTOELECTRIC CELLS
"Photronic" Cells – Dry Disc Type

PHOTOELECTRIC CONTROL DEVICES
"*Photronic" Cell Controls, Illumination Controls, Smoke Alarms, Industrial Controls

LIGHT MEASURING DEVICES
Illumination Meter, Foot Candle Meters. Sight Meter, Exposure Meters

TEMPERATURE INDICATING INSTRUMENTS
ELECTRICAL TYPE – Remote Indicating
BIMETALLIC DIAL TYPE – Laboratory, Industrial

INSTRUMENT ACCESSORIES AND PARTS
Shunts, Cables, Resistors, Switches, Binding Posts, Leads, Multipliers, Adapters, Radio Plugs, etc.

STANDARD CELLS

**Photronic – A registered trademark designating the photoelectric cells and photoelectric devices manufactured exclusively by the Weston Electrical Instrument Corporation.*

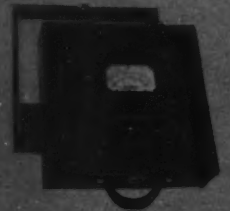
WESTON *Instruments*

Model 45
D. C. Instruments

Sturdy portable test instruments for accurate testing. Magnetically shielded, polished hardwood case. Accuracy ½ of 1%. Hand calibrated mirror scales of long length. Available in Voltmeters, Ammeters, Milliammeters, Volt-Ammeters.

Model 430
Portable, Precision A. C. and D. C. Instruments

Universally used in schools and industry wherever rugged, portable instruments are required for general testing. Hand calibrated, mirror scales with knife-edged pointers.



Model 785
Industrial Circuit Tester

Provides 27 ranges . . . all the ranges necessary for voltage, current and resistance measurements in signal, control and electronic circuits, or wherever else high sensitivity is a factor.

Model 489 and 528
Small A. C. and D. C. Instruments

Small, sturdy, inexpensive . . . for all-around A.C. and D.C. testing where moderate accuracy is sufficient. Available in Voltmeters, Ammeters, Milliammeters. A.C. models available in single, double and triple ranges.

Model 155
A. C. Instruments

Single or multi-range instruments, movable iron type, for general testing where high accuracy and long scale length are desired. Ammeters available with ranges up to 500 amperes, self-contained; Voltmeters up to 750 volts, self-contained. Sturdy, hardwood cases.

Model 433
A. C. Clamp Ammeter

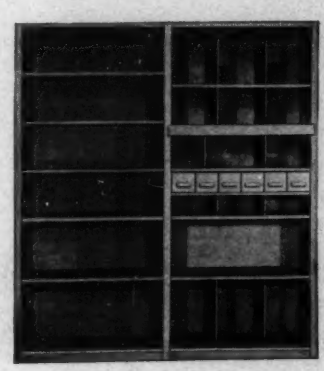
Current readings obtained simply by placing clamping jaws around conductor. Circuits never disturbed. 6 current ranges. High insulation for complete protection.

Model 772
Super-Sensitive Radio Set Tester

Sensitivity of 20,000 ohms per volt. Adequate voltage, current, resistance and output meter readings for servicing receivers, transmitters, P. A. systems, vacuum and cathode ray tube equipment, communications circuits, etc.

LYON SHOP EQUIPMENT

Engineered In Wood For The Duration



Adjustable Shelving

Lockers

Cabinets

Steel Work Benches

Sheet Metal Work Bench

Arc Welding Bench

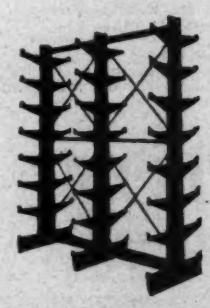
Wood Working Bench

Shop Desks

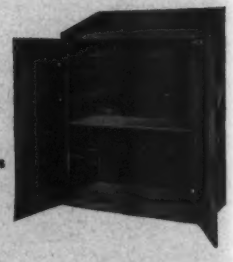
Gas Welding Bench

Drawer Units

Machine Tool Cabinet Bench



Bar Racks



Tool Cabinets

LYON METAL PRODUCTS, INC.

General Offices: 52 Madison Ave., Aurora, Illinois

Sales Offices in Principal Cities — See Your Local Telephone Directory

(Continued from page 46A)

cation and the council of social agencies. These work with you in the various neighborhoods and ferret out the trouble spots. They then organize adult groups to set up corrective programs.

In Philadelphia the "American Coast Patrol" aims to show wayward youth that it is much more fun to learn the ways of a sailor than to belong to a street gang.

Columbia, Mo., has clubs established in halls in various parts of the city. These "Teen Towns," as they are called, are managed by youth. They are open at stated hours for the various age levels and are equipped with snack bar, game rooms, and dancing facilities.

At Radford, Va., a "Play Park" for Negro youth has been opened. During a 21-month period after the establishment of the park, not a single Negro juvenile was brought into court.

The Boys' Club of America suggest that more boys' clubs be opened in congested war areas.

Association News

THE AMERICAN VOCATIONAL ASSOCIATION CONVENTION

(Continued from pages 18A and 22A of the February, 1944, issue)

The morning session of the industrial-education section on Wednesday, December 15, was presided over by Philip L. McNamee, assistant superintendent of schools, Chicago, Ill. The theme for this session was "The Part of Public Vocational Education in the Readjustment to Employment of Discharged Military Service Persons," and the subjects of the discussions were "The Federal Laws for Veterans' Rehabilitation and the Trend of Policies in the U. S. Veterans Administration With Respect to Rehabilitation Training," "The Prospective Federal Program of Employment Readjustment of Non-Disabled Veterans," and "The Facilities of the Public Schools for the Rehabilitation Training and Employment Readjustment of Disabled and Non-Disabled Veterans."

The chairman of the afternoon session was O. H. Day, director of vocational education, Kansas City, Mo. The subjects presented were "In the Building Construction Industry," "In the Metal Working Industries," "In the Field of Home Appliances," and "The Objectives of the Committee for Economic Development, With Implications for Public Vocational Education." The speakers on this occasion were Arthur A. Hood, director of dealer relations, Johns-Manville Sales Corporation, New York City; Joseph M. Schappert, director, department of industrial education, National Metal Trades Association, New York City; H. W. Arlin, manager of industrial relations, Westinghouse Electric and Manufacturing Company, Mansfield, Ohio; and Neil H. Jacoby, secretary, University of Chicago, Chicago, Ill.

Earl L. Bedell, director of vocational education, Detroit, Mich., acted as chairman at the Thursday afternoon session of the industrial-education session at which preinduction instruction in vocational schools was discussed.

The speakers were Major Ralph C. Wenrich, executive officer, Pre-Induction Training Branch, Office of the Director of Military Training, Headquarters, Army Service Forces, Washington, D. C.; J. Norwood Baker, principal, Murrell Dobbins Vocational School, Philadelphia, Pa.; O. F. Carpenter, principal, Wilbur Wright Vocational High School, Detroit, Mich.; and George F. Cassell, assistant superintendent of schools, Chicago, Ill.

Another session of this section also held Thursday afternoon was presided over by W. F. Stewart, vice-president for part-time schools, American Vocational Association, Inc., Department of Agricultural Education, Ohio State University, Columbus, Ohio. The subjects discussed were "Vocational Technical Education," "The Interest of Engineering Colleges in Vocational Technical Education," "The Revival of Apprenticeship in the Manufacturing and Construction Industries, With Implications for Pre-Employment Preparation and for Part-Time Technical Instruction During Apprenticeship," and "Public Vocational Education for Training of Industrial Personnel for Foremanship and Supervisory Positions, and for Improving Present Supervisory Personnel."

The part-time industrial-education section which met at 9:30 a.m. Friday, December 17, was presided over by Harry A. Tiemann, state director of vocational education, Denver, Colo. The general theme was "Work Experience and Occupational Adjustment." The speakers were Oakley Furney, chief, industrial and technical education bureau, State Department of Education, Albany, N. Y.; James R. D. Eddy, state director for trade and industrial education, Austin, Tex.; Ralph H. Woods, state director of vocational education, Frankfort, Ky.; Mrs. Leonora H. Zimmerman, state supervisor of homemaking education, Denver, Colo.; Willis M. Kenealy, regional supervisor of distributive education, Los Angeles, Calif.; and Sidney Owen, state director of vocational education, Lincoln, Neb.

In this session great emphasis was placed on the value of work experiences as a means of self-expression, the formation of the right kind of work habits, and the development of resourcefulness.

The subjects of "Occupational Information and Guidance," and "Vocational Rehabilitation" were also given appropriate emphasis at several sec-

(Continued on next page)

TEACH THEM WITH THE TOOLS THEY WILL USE ON THE JOB!

Dumore Hand Grinders are invaluable for die finishing, carving, and many maintenance operations. 3 sizes shown in Catalog 42.

WHEN they go into industry, your students will find Dumore Precision Grinders widely used. These versatile tools are enabling every type of metal working plant to secure greater precision at lower cost. They offer the training school the same outstanding advantages, and serve to familiarize the trainee with the care and operation of a fine, precision instrument. Catalog 42 describes the full line in great detail, and illustrates a wide variety of applications. Send for a copy today. The Dumore Company, Tool Division, Racine, Wisconsin.

Dumore PRECISION and Off-Hand GRINDERS

DUMORE GRINDERS ARE SOLD THROUGH AUTHORIZED INDUSTRIAL DISTRIBUTORS IN ALL PRINCIPAL CITIES

(Continued from previous page)

tional meetings held on Thursday, December 16.

The gala occasion was the banquet held Wednesday evening at 7:00 p.m.

Fred A. Smith, president of the association, presided, and Edward J. Condon, assistant to the president, Sears-Roebuck and Company, Chicago, Ill., was the toastmaster.

The main speaker on the program was Frank M. Gunn, Works Manager, Pullman Standard Car Manufacturing Company, Chicago, Ill.

Robert Bowman, national president, Future Farmers of America, Buttonwillow, Calif., gave "A Brief Message From Youth," emphasizing that the members of his organization are working hard to produce as much food as possible for the boys at the front and the folks at home.

Dr. Charles Allen Prosser was especially honored at the annual banquet by the distribution of a booklet written by Dr. Homer J. Smith entitled "Prosser's Continuous Contribution."

Among the resolutions adopted by the association, the following are especially noteworthy:

Whereas: Since the vocational rehabilitation program has been separated from the United States Office of Education and established as a new division of the Social Security Agency, the various State Boards for Vocational Education are now compelled to deal with two separate agencies in the field of vocational training, and

Whereas: Vocational training is one of the most important phases of any sound vocational rehabilitation program, and

Whereas: There is a probability of duplication of payment for the same service from two federal sources, (1) by reimbursement from regular federal vocational education of classes in local schools, and (2) from federal rehabilitation funds for tuition of vocational rehabilitation clients enrolled in the same classes,

Therefore Be It Resolved: That the national administration of the civilian vocational rehabilitation program be returned to the vocational division of the United States Office of Education.

* * *

Whereas: The vocational schools of America have carried out during the past three years the most gigantic task of vocational training ever undertaken by any nation in peace or war, and

Whereas: The United States Navy and the United States Army as well as industry and labor have expressed appreciation for the fine service rendered the war effort by the vocational schools, and

Whereas: Certain equipment and facilities have been made available by or through the war-training programs to enable vocational education to provide a more effective program not only during but after the war,

Therefore Be It Resolved: That the states inaugurate effective planning for postwar programs in vocational education which will include effective training and adjustment for the returned soldiers; for the millions of war-production workers who may need additional training or retraining for peacetime occupations; and for all those who will face readjustments in family life.

* * *

Whereas: New skills will be needed to enable returned servicemen to enter gainful peacetime employment, and

Whereas: The State Boards for Vocational Education of the several states and territories of Hawaii and Puerto Rico have rendered significant service in the vocational training of war-workers, and

Whereas: The vocational schools have, with the aid of federal funds, provided by the Congress much of the basic equipment, facilities, and trained administrative and instructing personnel to meet the training needs of returned servicemen, and

Whereas: Public sentiment does not favor the establishment of duplicating training boards and bureaus either on the national or state levels,

Therefore Be It Resolved: That the American Vocational Association recommend that instead of providing tuition payments to educational institutions that funds be appropriated through the United States Office of Education to be allotted to the respective states and state boards specifically responsible for the various types of education.

The officers elected are: president, John A. McCarthy, assistant commissioner of education, Trenton, N. J.; treasurer, Charles W. Sylvester, director of vocational education, Baltimore, Md.; vice-president for industrial education, George H. Fern, state director for vocational education, Michigan; vice-president for Vocational Rehabilitation, Claude Andrews, state supervisor of vocational rehabilitation, Florida; and president, Association of Officers of State Vocational Associations, Ralph H. Woods, director of vocational education, Kentucky.

The meeting next year will be held at Philadelphia.

The Ship's program was held directly after the annual business meeting on Thursday. C. A. Roper, McKnight and McKnight, Bloomington, Ill., captain of the Ship, was in charge. It presented the usual entertainment program, but it also presented a patriotic and reverential aspect when the names of commercial exhibitors, who usually were present, but now are in the armed forces, were read, and when the war dead from the vocational field were specially honored.

The 1943 Ship citation for outstanding services in the field of vocational education was presented by John A. Backus, American Type Founders Sales Corporation, Elizabeth, N. J., to Dr. L. H. Dennis, executive secretary, American Vocational Association, Inc., Washington, D. C.

♦ The Michigan Industrial Education Society will hold its convention at the Pantlind Hotel, Grand Rapids, Mich., on April 20, 21, and 22.

♦ The 13th annual convention of the Indiana Industrial Education Association will be held April 28 and 29, 1944 at Indianapolis, Ind.

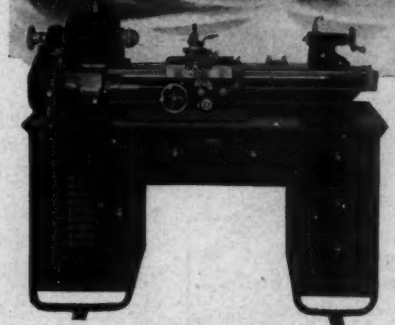
♦ The Department of Education of the University of Chicago will maintain headquarters at the sectional meetings of the American Association of School Administrators in Chicago (February 28, 29, and March 1), and in Kansas City (March 8, 9, and 10). The Chicago headquarters will be in the Palmer House and the Kansas City headquarters in the Muehlebach Hotel.

(Continued on page 54A)

By the U.S. Army, the Marines, and the Navy, too

SHELDON Precision Lathes have been selected by the Army for its Mobile Machine-Shop Units, by the Marine Corps for its trailerized shops and by the Navy as the ideal lathes for several types of repair shop aboard ship and ashore.

SHELDON Lathes are also widely used in British, Canadian, South African, Russian and other allied factories to speed the production and maintenance of war material . . . proof of worldwide SHELDON accuracy and dependability.



SHELDON 10" (1-inch collet capacity Precision Lathe and Bench Unit with E-type underneath motor drive.

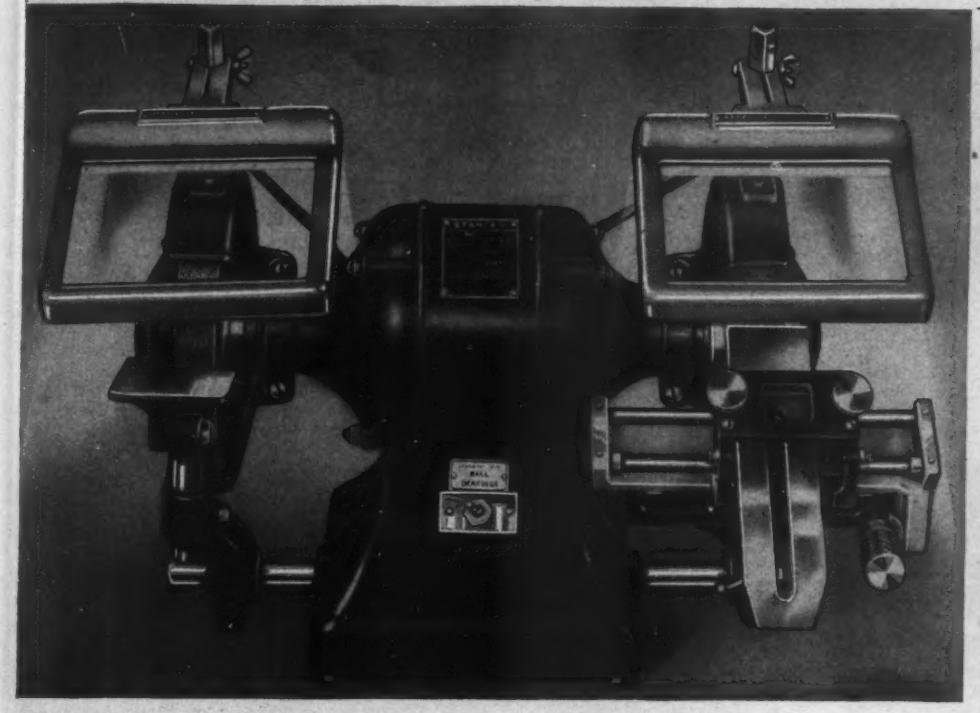
SHELDON

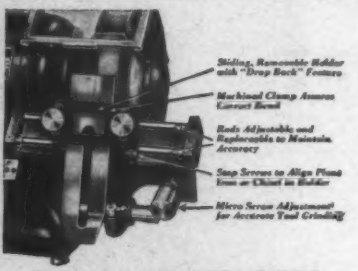
SHELDON MACHINE CO., INC.

4244 N. Knox Ave. Chicago 41, U.S.A.

STANLEY

ELECTRIC TOOLS (TRADE STANLEY MARK) FOR SCHOOL SHOPS



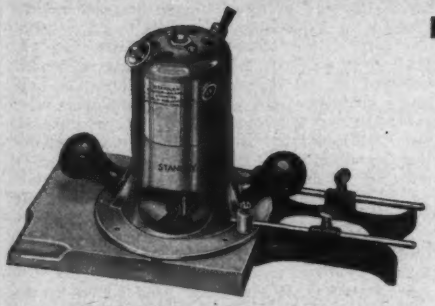

Sliding, Removable Holder with "Drop Back" Feature
Machined Clamp Assures Correct Bevel
Rods Adjustable and Replaceable to Maintain Accuracy
Snap Screws to Align Plane Iron or Chisel in Holder
Micro Screw Adjustment for Accurate Tool Grinding

PLANE IRON AND CHISEL GRINDING FIXTURE

Standard equipment with the No. 677 Grinder, keeps edge tools accurately beveled. Takes plane irons up to 2⅛" wide and chisels of any size. Micro screw feed adjustment.

STANLEY "FLUD-LITE" EYE SHIELD

Effective eye-protection combined with better vision. Two light bulbs with reflectors floodlight work area, help prevent injuries. Adjustable up and down, and tilts to suit operator's position. Cannot be moved to non-guarding position without dismantling. Standard equipment on No. 677 Grinder. Can be attached to all similar bench or belt-driven grinders.



No. 677 EDGE TOOL GRINDER

Every wood-working shop needs this improved, full ball bearing Bench Grinder. Powered by a ⅓ H.P. induction motor, fully enclosed, it operates at the correct speed for edge tool grinding. Equipped with "Flud-Lite" Eye Shields, one Adjustable Tool Rest, and the Plane Iron and Chisel Grinding Fixture.

HAND ROUTER No. 10

Fast – 18,000 R.P.M. – assuring a smooth finish that makes sanding practically unnecessary. For Shaping, Inlay Work, Routing, Templet Work, Veining, Grooving, Rabbeting, Corner Beading, etc. The power unit may also be quickly attached to a Beading and Fluting unit or to a shaper table. Provides a great variety of practical cuts and a wide range of decorative operations at a very low cost.

BE SURE YOU HAVE THESE STANLEY CATALOGS

No. 67 STANLEY ELECTRIC TOOL CATALOG

Describes and illustrates the complete line of Stanley Electric Drills, Saws, Unishears, Grinders and other tools. Write for a copy.

No. 606 ROUTER-SHAPER CATALOG

Describes Stanley Router-Shapers, and all the various attachments and applications. Keep a copy on hand for reference.

STANLEY ELECTRIC TOOL DIVISION EDUCATIONAL DEPARTMENT
THE STANLEY WORKS, NEW BRITAIN, CONN.

(Continued from page 52A)

♦ The National Institutional Teacher Placement Association is holding meetings at the time of the sectional meetings of the American Association of School Administrators. The members of the organization in charge of the sectional meetings are:

Mr. N. J. Aiken, Seattle; Mrs. Dorothy S. Whitehead, Atlanta; Mr. Charles A. Fisher, New York; Mr. Frank S. Endicott, Chicago; and Mr. Ray C. Maul, Kansas City.

Personal News

♦ GLEN D. BROWN, Professor of industrial education and head of that department at the University of Maryland, Baltimore, Md., is now serving as Assistant State Director of Vocational Education in charge of the regular vocational and industrial-arts program in Maryland schools. In his dual capacity, Mr. Brown will have the opportunity of articulating state department vocational education activities with the important task of vocational teacher training at the university, which will include itinerant teacher training through various centers in the state.

During the period from July 1, 1943, to January 1, 1944, Mr. Brown served as Acting State Director of Vocational Education and as Director of Vocational War Training programs.

♦ JOHN J. SEIDEL, assistant superintendent for vocational education in the state of Maryland, returned to his regular position with the State Department of Education on January 1, after an absence of six months during which time he served in the Office of Education as Deputy Assistant Commissioner for Vocational Education.

♦ LOUIS G. WUST, formerly a teacher in the public schools of Providence, R. I., has recently joined the faculty of the Abbot Vocational School for Boys, at Washington, D. C.

♦ ROBERT M. WINGER joined the staff of the Michigan State Board of Control for Vocational Education August 16, 1943, as supervisor of distributive education.

Mr. Winger is a native of Indiana, a graduate of Manchester College, Indiana, with a masters degree from Wayne University. He has had retail and specialty selling experience in business, taught in Portland, Ind., and since 1927 has been a member of the Detroit Public School system. He is now released on leave of absence from his position as teacher and co-ordinator of cooperative business training at Wilbur Wright Vocational High School, Detroit.

♦ WILLIAM E. ANDERSON joined the staff of the Michigan State Board of Control for Vocational Education as a rehabilitation field agent on September 16, 1943. He was assigned to the Gaylord district office.

Mr. Anderson was graduated from the Menominee High School, attended Ferris Institute for three years specializing in business administration, and was graduated from the University of Michigan with LL.B., and A.B. degrees after majoring in political sciences and law. He is a member of the State Bar. Previous to his employment as rehabilitation field agent, he was supervisor of the Menominee County Bureau of Social Aid.

♦ THOMAS NULL has been appointed co-ordinator of the cooperative business education program at Monroe, Mich. He was formerly coordinator of distributive education in East Moline, Ill., high school.

♦ FRANK E. KESSLER, a staff member of the Michigan State Board of Control for Vocational Education as welding certification officer, attended Saginaw High School, and continued his studies, on a cooperative basis, at the General Motors Institute of Technology, serving his apprenticeship at the Chevrolet Gray Iron Foundry, Division of General Motors Corp. In 1931 he joined the U. S. Navy serving aboard the U.S.S. *Lexington* and U.S.S. *Tennessee* as aviation welding instructor. After receiving his honorable discharge in 1935, he was for a time a welder with the Tool and Die Department of Fisher Body Corp., and later welding instructor for the Naval Air Station, Pensacola, Fla., and for Lockheed Aircraft Corp., Burbank, Calif. He was also welding instructor in the Flint program of war-production work.

♦ STAFF SGT. HENRY P. PAQUET, the first member of the staff of the Michigan State Board of Control for Vocational Education to enter military service, was killed in action September 17, 1943, in the North African area. He had participated in the invasion of North Africa and was a member of the group of paratroopers who made the first landings in Sicily on July 11. He was slightly injured when a bridge on which he was standing was blasted, but soon afterward returned to duty as a member of the military police. It is believed that he lost his life in the invasion of the Italian mainland.

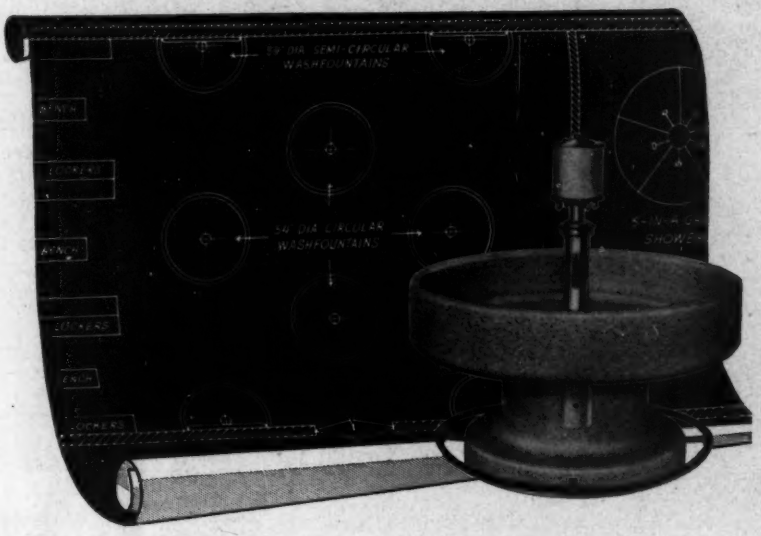
Sgt. Paquet is survived by his parents, two brothers who are both in service, his wife, and a son.

♦ EDWARD C. RUMSEY has been added to the staff of the Michigan State Board of Control for Vocational Education as an itinerant instructor in the training of firemen in special techniques in the use of equipment. He has been with the Detroit fire department for 27 years, and occupied the position of Chief of the Bureau of Apparatus and High Pressure when he retired to start his new work, sponsored jointly by the University of Michigan and the State Board. His services will be in the city fire departments principally.

♦ H. G. MCCOMB, a leader in trade and industrial education and in the war-production training field in the state of Indiana, was awarded a life membership in the American Vocational Association at the annual A.V.A. convention in Chicago.

Mr. McComb also was presented with a leather bound album containing the signatures of nearly 300 contributors to this trophy, together with an inscription in recognition of his service in the

(Continued on page 56A)



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Washroom Layout Assistance

To help you extend or add washroom facilities — or to work with your architects on new school, college, or institution buildings, our Washroom Engineers are ready to make floor plan suggestions and forward you a copy of our new catalog 4308. . . . Bradley Washfountain Co., 2269 W. Michigan Street, Milwaukee 1, Wisconsin.

BRADLEY washfountains

You KNOW that you can depend on DISSTON

When you decided on Disston tools for your school workshop, you made your choice on the basis of *quality*. And that quality is repaying you today in long service and lasting satisfaction. The advantage of having invested in tools by Disston is particularly evident now when new tools must be conserved for vital wartime uses.

Made of fine Disston Steel, Disston tools maintain their high standards of performance through years of useful life. That is why these quality tools have long been an inspiration to better work, with young and old craftsmen alike.

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Woodworking Equipment, Tools, and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

BENCH
- *a*) Shop, with hardwood tops, 1¾ in. or over in thickness, the top to project far enough to allow a rapid-acting or continuous-screw vise to be attached.
  It may be well to order a 1-in. birch or maple board wide enough to cover the working face of the bench at the time of buying the benches. This board can then be fastened to the top proper with screws and may be conveniently replaced when worn. The benches should be made of thoroughly kiln-dried lumber throughout. They may be either plain or of 6-drawer type
- *b*) Glue
- *c*) Stain, with metal-covered top
- *d*) Teacher's demonstration

BLACKBOARD — permanent or portable

BOOKCASE

BULLETIN BOARD

CABINETS — wood or metal for filing class records, instruction sheets, drawings, finishing materials, hardware, small tools, supplies, etc.

CHAIRS — teacher's and tablet arm

CORE OVEN — for patternmaking class

DESK — teacher's, with drawer compartments

FURNACE — for melting soft metals (for patternmaking class)

GLUEPOT — 1 qt. or 2 qt., electric, gas, or steam heat

GLUE WARMER OR COOKER — 1- to 5-gal. capacity

GRINDER
- *a*) Automatic knife, direct-motor type. Size to suit largest knife used in school shop, complete with water pump, grinding wheel, and automatic stops
- *b*) Bench, hand or power
- *c*) Bench, motor-in-head. Motor bearings to be completely housed, wheels to be equipped with safety flanges and carefully guarded throughout. One fine-grit, and one coarse-grit wheel
- *d*) Revolving oilstone, pedestal type, with one fine and one coarse oilstone

JOINTER
- *a*) 6-in. or 8-in. portable jointer. Table to be fitted for rabbetting. Safety-cylinder type, equipped with safety guard
- *b*) 12, 16, or 18 in. direct motor drive, ball bearing. Cylinder to be of safety-head type. Table to be fitted for rabbetting. Jointer to be equipped with safety guard

LATHES
- *a*) 6-in. to 16-in. motor-in-head, motor-in-base, or belt-driven speed lathe, to take 24, 36, 48, 60, or 72 in. between centers. Each to be complete with cup center, spur center, faceplate, rosette chuck, tool rests, and center drift for head block
- *b*) Patternmakers', with end faceplate provision. Lathe to be of direct-motor-drive type, equipped with variable-speed motor, faceplates and floor stand. (For patternmaking class)

MORTISER
- *a*) Direct-motor-drive, or belt-driven, hollow-chisel mortiser, foot feed. Table to be of the tilting type with hold-down clamps and stop rod
- *b*) Portable, vertical, hollow-chisel mortiser, bench type

PLANER — 12, 18, 20, 24, or 30-in., motor or belt-driven, single-surface planer. Safety-head cylinder, three-knife type, fitted with good-grade steel knives. Knife-setting and jointing device complete with bar should be mounted on machine if possible

SANDER
- *a*) Belt, direct motor drive
- *b*) Disk, motor or belt driven
- *c*) Oscillating spindle, motor driven
- *d*) Portable, hand-plane type, direct motor drive
- *e*) Vertical spindle and disk sander

SAWS
- *a*) Band saw, 20 to 36 in., motor drive. Upper and lower wheels to be completely guarded. Table to tilt to 45 deg.
- *b*) Combination, band saw, crosscut saw, ripsaw, and mortiser. Machine to be completely guarded
- *c*) Cutoff, pedestal or swing type to be fitted with 12-in. to 16-in. saw
- *d*) Filing machine, direct motor drive
- *e*) Jig, direct motor or belt driven
- *f*) Portable band saw, 14 to 20 in. ball bearing, motor driven
- *g*) Saw bench, directly connected to motor, and to have both rip and crosscut saws. Rip and crosscut gauges also to be provided
- *h*) Universal saw bench, 14 to 16 in., motor driven
- *j*) Variety saw bench, motor driven, tilting table, with universal sliding table. The arbor is to be fitted for a dado head, and the table is to be slotted accordingly. The saw is to be equipped with ripping fence and miter cutoff gauges

SHAPER
- *a*) Motor drive, single or double spindle. Table to be equipped with removable center plate
- *b*) Portable shaper or router with a suitable selection of cutters

TENONER — single end, with coping heads and cutoff saw

VISES — rapid-acting or solid-nut type woodworking-bench vises, 7 to 10 in.

WOOD TRIMMERS — complete with all gauges and taper pins. Base of trimmer to be slotted and laid out for degree settings (for patternmaking class)

Woodworking—Small Tools

AWLS — brad, assorted sizes

BEVELS
- *a*) Protractor
- *b*) Sliding T, 8 in.

BITS
- *a*) Auger, 3/16 in. to 1 in. inclusive, by 16ths
- *b*) Auger, 3/16 in. to ½ in. inclusive, by 16ths
- *c*) Braces, ratchet type, 8-, 10-, 12-, or 14-in. sweep
- *d*) Countersink, for wood, rose pattern, ½ in. and ⅝ in.
- *e*) Dowel, square shank, ¼ in., 5/16 in., ⅜ in., ½ in., ¾ in.
- *f*) Expansive, ⅞ in. to 1½ in.
- *g*) Expansive, ⅜ in. to 3 in.
- *h*) Forstner, square shank, ¼ in. to ½ in. inclusive, by 16ths
- *j*) Screw driver, square shank, ¼ in., 5/16 in., ⅜ in.
- *k*) Twist drill for wood, square shank, 1/16 in. to ⅜ in. inclusive, by 16ths
- *l*) Twist drill, straight shank, 1/16 in. to ⅜ in., inclusive, by 32nds

BLOWTORCH

BROOMS

BRUSHES
- *a*) Bench duster, 10 in.
- *b*) Floor
- *c*) Glue, round, 1½ in. and ¾ in.
- *d*) Glue, round, 1½ in.
- *e*) Marking, camel's hair, No. 1 and No. 2
- *f*) Varnish, flowing, 2 in. and 2½ in.
- *g*) Varnish, flat, ½ in., ¾ in., and 1 in.

BURNISHERS — oval or round

CAN OPENER

CARVING TOOLS
- *a*) Sets containing 6 tools
- *b*) Sets containing 12 tools

CHISELS
- *a*) Cold, machinists', ⅜ in. and ½ in.
- *b*) Mortising chisel and bits, ¼ in. to ⅝ in. by 16ths
- *c*) Socket firmer, bevel edge, ⅛ in., ¼ in., ½ in., ¾ in., 1 in., and 1½ in.

(Continued on page 58A)

(Continued from page 54A)

field of industrial arts and vocational education.

♦ EDGAR J. SPADY is the new Director of War Training and General Co-ordinator of Vocational Education at the Oklahoma City Public Schools. He was formerly the director of industrial education at Richmond, Ind.

♦ HARVEY G. BERGNER, formerly on the faculty of the Madison Vocational and Adult Education School, Madison, Wis., recently was commissioned a lieutenant in the U. S. Naval Reserve.

♦ WARREN BEGEMAN has been appointed supervisor of industrial arts at St. Louis, Mo., in place of George H. Hargitt, who has been made principal of one of the St. Louis schools.

♦ SYLVAN A. YAGER of Indiana State addressed the teachers of industrial arts at the annual meeting of the Southwestern Ohio Teachers Association Convention in Cincinnati, Ohio, on October 20, 1943.

♦ EUGENE CLEHOUSE, machine-shop inspector in the Richmond High School, Richmond, Ind., was recently inducted into the military service and is now stationed at Fort Belvoir, Va.

♦ NICK OPROSU of Terre Haute, Ind., is doing substitute teaching in industrial arts at New Goshen, Ind. He is taking the place of Arthur Mosele who recently entered the army.

♦ FRANCIS FIRMANI, formerly of Logansport, Ind., is now teaching general shop at Columbus, Ind.

♦ LEWIS HODGES, president of the Michigan Industrial Education Society, is now a lieutenant of the Naval Reserve. Lt. Hodges' work will be in the field of education, especially in training warworkers.

♦ ANDREW ALTHOUSE, Division of Instruction, Detroit, Mich., has been elevated to the presidency of the Michigan Industrial Education Society, to take the place of Lt. Lewis Hodges, now in the Naval Reserve. ARCHIE NEVINS, director of industrial education at Kalamazoo, Mich., has been elected vice-president of this association.

♦ DEAN V. C. CALDWELL, formerly director of the Oregon State College summer sessions, died suddenly in November, 1943. His successor will assume duties shortly. In the interim, W. G. Beattie is the acting director.

♦ FRANKLIN H. THOMAS, principal of the Boys' Vocational School, St. Paul, Minn., for nearly 25 years, died October 28 at his farm home near Rib Lake, Wis.

Mr. Thomas had been connected with the Vocational School since it was first organized. In February, 1919, when classes in vocational training were organized under the direction of the late Geo. M. Brace in each of the two high

(Continued on page 63A)

GOOD TOOLS for School Shops

Write for Catalog No. 34 showing STANLEY TOOLS for your School Shops

FOR WOODWORKING AND FARM SHOPS
The most complete line offered by one manufacturer.

FOR ELECTRICAL SHOPS
Hammers, Bit Braces, Bit Extension, Screw Drivers, etc.

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Visual Teaching Aids and Project Plans available at cost.

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STANLEY
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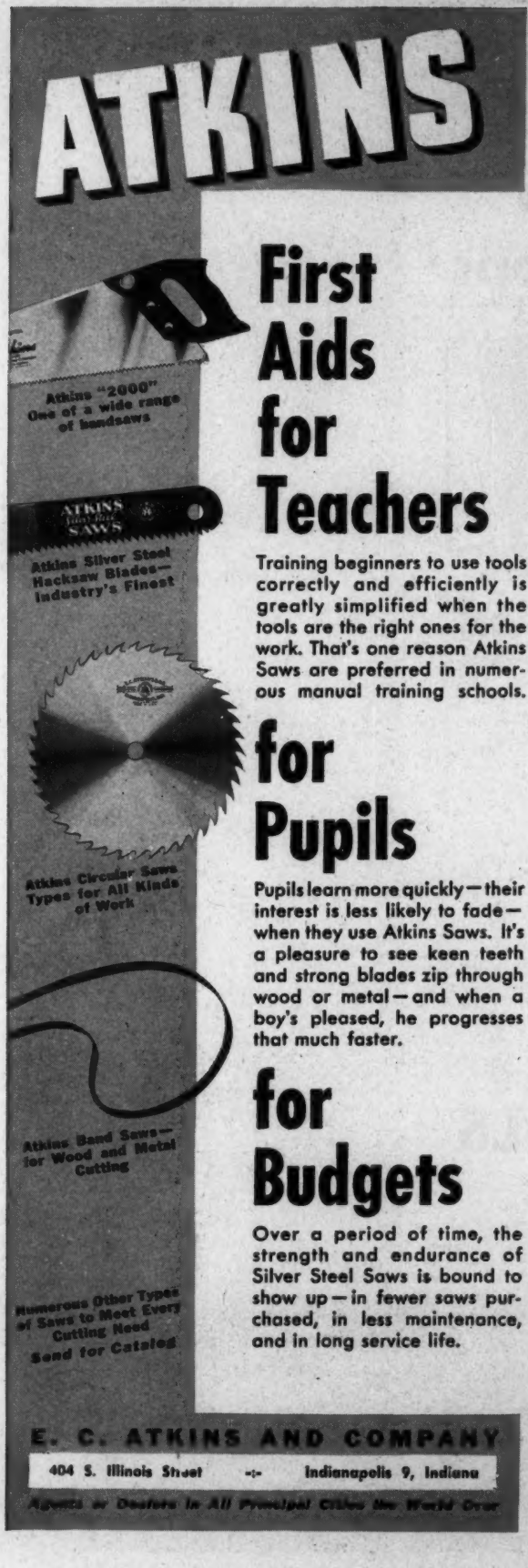
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First Aids for Teachers
Training beginners to use tools correctly and efficiently is greatly simplified when the tools are the right ones for the work. That's one reason Atkins Saws are preferred in numerous manual training schools.
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Pupils learn more quickly—their interest is less likely to fade—when they use Atkins Saws. It's a pleasure to see keen teeth and strong blades zip through wood or metal—and when a boy's pleased, he progresses that much faster.
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Atkins "2000" One of a wide range of handsaws
Atkins Silver Steel Hacksaw Blades—Industry's Finest
Atkins Circular Saws Types for All Kinds of Work
Atkins Band Saws—for Wood and Metal Cutting
Numerous Other Types of Saws to Meet Every Cutting Need
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E. C. ATKINS AND COMPANY
404 S. Illinois Street -:- Indianapolis 9, Indiana
Agents or Dealers in All Principal Cities the World Over

(Continued from page 56A)

d) Socket firmer, plain edge, ½ in., ¾ in., and 1 in.
e) Tanged firmer, bevel edge, ⅜, ½, ⅝, ¾, 1, and 1¼ in.

CLAMPS
a) Bar, 24, 36, 48, and 60 in.
b) Hand-screw, 4, 5, 6, 7, 8, 10, 12, and 14 in.
c) Malleable-iron C, 4, 6, and 8 in.

DIVIDERS — wing, 6 in. and 10 in.
DOWEL PLATE — 6 in. long
DOWELING JIGS — with bushings
DRAWKNIVES — 7 in.
DRILL
a) Automatic hand, with 8 drill points
b) Chuck, 0 to ⅜ in.
c) Hand, 0 to ⅜ in., for round-shank drills
d) Star, for concrete, ½ in. and ¾ in.

FILES
a) Auger bit, assorted, 6 in.
b) Cabinet, 8 in. and 10 in.
c) Card and brush
d) Flat, wood, 10 in.
e) Mill, bastard cut, 12 in.
f) Round, bastard cut, 12 in.
g) Taper, slim, 5½ in. and 7 in.

FIRST-AID CABINET AND SUPPLIES
GAUGES
a) Bit, adjustable
b) Jointer
c) Marking, metal or hardwood
d) Mortise, metal or hardwood
e) Panel

GLASS CUTTER
GOUGES
a) Tanged firmer, outside ground, handled, ⅛, ¼, ½, ¾, and 1 in.
b) Tanged firmer, inside ground, handled, ⅛, ¼, ½, ¾, and 1 in.
c) Spoon, ½, ¾, and 1 in.

HAMMERS — claw, bell faced, 10, 12, 13, and 16-oz.
HATCHET — bench, 4-in. cut
JARS — earthenware, 1-qt. capacity
KNIVES
a) Jointer, to fit power machine
b) Planer, to fit power machine
c) Sloyd, 3-in. blade

LEVELS
a) Wood, 24 in.
b) Machinists', 12 in.

MALLETS — hickory, 3 by 5 in. head
NAIL SETS — 1/16 in. and 3/32 in. points
OILERS — bench, 1/3 pt., coppered, best grade
OILSTONES
a) 1 by 2 by 8 in. in iron box
b) Gouge slip, medium, 4½ by 2⅜ by ⅝ by 5/16 in.
c) Gouge slip, fine, 3 by 2 by ⅜ by ⅛ in.

PINCERS — 6 in. carpenters'
PINCH DOGS — ¾, 1, and 1¼ in.
PLANES
a) Block, adjustable, 6 in. long, 1⅝-in. cutter
b) Circular
c) Combination, adjustable
d) Core box
e) Duplex, fillister and rabbet
f) Fore, ½ in., 2⅜-in. cutter
g) Irons, double
h) Jack, 14 in., 2-in. cutter
j) Jointer, 24 in.
k) Round, wood, 1¾ in.
l) Router
m) Smooth, 9 in., 1¾ in. or 2-in. cutter

PLIERS
a) Roundnose, 5 in.
b) Side-cutting, 6 in.

PUTTY KNIVES
RASPS — half round, wood, 10 in.
RULES
a) Board
b) 1 ft. or 2 ft. graduated by 8ths and 16ths
c) Shrink, ⅛ in., 3/16 in.

SAWS
a) Back, 12 in., 14 point
b) Band, to fit power machine
c) Compass, 10 in.
d) Coping, frames
e) Coping, blades
f) Crosscut, 9 tooth, 22 in. long
g) Crosscut, circular for power machine
h) Dado, ⅛ in. to 1 1/16 in. to fit power-saw arbor
j) Hack, frames, 10 in. or adjustable
k) Hack, blades, 10 in.
l) Keyhole, 10 in., 10 point
m) Rip, 7 point, 22 in. long
n) Rip, circular for power machine
o) Set, 10 points per inch and finer
p) Set, 10 points per inch and coarser
q) Turning frame, 14 in.
r) Turning blades, 3/16 by 12 in., 10 tooth
s) Miter box, 24 by 4 in. saw, 7-in. capacity at miter

SCRAPERS
a) Cabinet
b) Glue, triangular
c) Veneer, blade, 2¾ in. long, handle 11 in. long

SCREW DRIVERS
a) Cabinetmakers', 4, 6, and 8 in.
b) Quick return, spiral ratchet

SHOOT BOARD — and plane
SNIPS — tinners', forged steel, 2½-in. cut
SPOKESHAVES — adjustable, raised handle, 10 in. long
SQUARES
a) Combination, 12 in.
b) Try-, iron handle, 8 in.
c) Framing, 2 ft.

STEEL FIGURES — hand cut, ⅛ in.
TAPELINE — 50 ft., steel
TRAMMEL POINTS — adjustable metal frame, steel points
TURNING TOOLS
a) Calipers, 6 in. inside and outside
b) Calipers, 12 in. inside and outside
c) Parting tools, ⅛ in.
d) Round point, ¼ in., ½ in., ¾ in.
e) Spear point, ¼ in., ½ in., ¾ in.
f) Square point, ¼ in., ½ in., ¾ in.
g) Turning chisels, ¼ in., ½ in., ¾ in.
h) Turning gouges, ¼ in., ½ in., ¾ in.
j) Turning skews, L.H., ¼ in., ½ in., ¾ in.
k) Turning skews, R.H., ¼ in., ½ in.

VISE — 3-in. jaw, anvil face
WRENCHES
a) Adjustable, 8, 10, and 12 in.
b) Headless setscrew
c) Pipe, 10 in. and 12 in.
d) S type or open-end type to fit ⅛-in. to 1-in. N.C. nuts

(Continued on page 60A)

Woodworking Machines

FOR EVERY SCHOOL SHOP NEED

24-in. Single Surface Planer

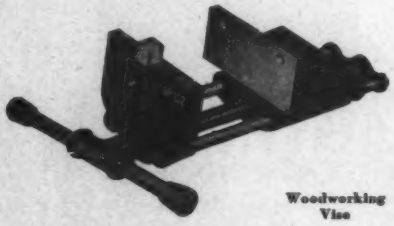
Double Arbor, Motor Arbor, Tilting Saw Bench

8-inch Hand Planer and Jointer

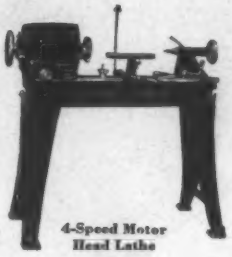
Hollow Chisel Mortiser

Disk Sander

Tilting Arbor Variety Saw Bench



Woodworking Vise



4-Speed Motor Head Lathe

Oilstone Tool Grinder

Electric Band Saw Brazer

Wood Trimmer

30-inch Band Saw

Years of satisfactory service in the woodworking industry preceding school shop acceptance and use has given "Oliver" a background of experience in providing the school shop requirements.

Safety is the keynote of "Oliver" design. Students are protected from injury by the newest and best safety devices. For performance, "Oliver" machines have those plus features that make them withstand hard usage of beginning woodworkers over a period of many years.

Special cooperation extended to school shop executives in organizing, planning and equipping woodworking shops. Inquiries and correspondence relative to requirements are solicited.

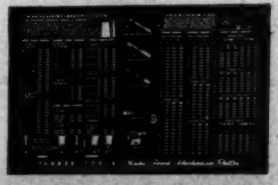
The Oliver line of equipment includes: Wood Lathes, Sanders (Belt, Disk or Spindle), Boring Machines, Mortisers, Tenoners, Shapers, Circular Saw Benches, Band Saws, Band Saw Brazers, Jig Saws, Surface Planers, Jointers, Wood Trimmers, Oilstone Tool Grinders, Woodworkers Vises, Glue Heaters, Knives, Saws, Metal Spinning Lathes, Electric Glue Heaters.

Write for circulars illustrating any or all of these machines

Oliver Machinery Company
Grand Rapids 2, Michigan, U.S.A.

Good mechanics may be born, not made. But better mechanics are *made* by "Yankee" Fine Mechanics' Tools, the choice of discriminating users everywhere, for more than half a century. And why are "Yankee" Tools their choice? Because they have been *designed* to save time, money, and trouble on their jobs . . . and because they are *built* to give long, hard, dependable service. There's a better-mouse-trap ingenuity about "Yankee" Tools that makes them teacher's pet. But now, of course, "Yankee" Tools are working for war, and Demand has made a Casualty of supply. But Victory will mend all that, and you will one day again be training youth and inexperience with the tools that age and experience demand.

FREE! Write for a copy of the handy "Yankee" Reference Chart, featuring relative tables of screw-driver blade and screw sizes, and giving graphic instructions on how to drive screws correctly.



"YANKEE" TOOLS
make good mechanics better
North Bros. Mfg. Co., Phila. 33, U. S. A.
Established 1880

Woodworking—Materials and Supplies

ALCOHOL

BENZINE

BRADS — ⅜ in., ½ in., and ⅝ in. No. 20; ¾ in. and ⅞ in. No. 19; 1 in. No. 18; 1¼ in. and 1½ in. No. 16; 1¾ in. No. 15; 2 in. and 2½ in. No. 14

CARBON PAPER — black

COLORS — dry: burnt sienna, burnt umber, cobalt blue, chrome yellow, drop black, lamp black, Prussian blue, raw umber, Vandyke brown, and vermilion

COLORS — ground, in oil or japan: burnt sienna, burnt umber, cobalt blue, chrome yellow, drop black, lamp black, Prussian blue, raw umber, rose lake, Vandyke brown, and vermilion

DECALCOMANIA TRANSFERS

DOWEL PINS AND PLATES

DOWELS: hardwood, 3-ft. lengths, ¼ in., 5/16 in., ⅜ in., ½ in., ¾ in.

ENAMEL
- *a*) Selected colors
- *b*) Undercoater

FILLERS — paste: natural, golden oak, dark oak, and mahogany

FILLETS — leather, ¼ in. and ½ in.

GLUE
- *a*) Casein, hide, best grade cabinet
- *b*) Liquid

HARDWARE: Brackets, buttons, butts, casters, catches, chain, chest corners, chest trimmings, corner braces, corner irons, corner plates, desk fittings, door fittings, escutcheons, fasteners, handles, hangers, hinges, hasps, holders, hooks, knobs, latches, lamp fittings, lid supports, locks, pulls, smoking-stand outfits, springs, stops, supports

HOOKS
- *a*) And eyes
- *b*) Cup
- *c*) Screw and
- *d*) Square screw

LACQUER — black, clear, cobalt blue, ivory, medium green, red, thinner, white, and yellow

LUMBER — Ash, balsa, bass, birch, cherry, cypress, locust, mahogany, maple, oak, poplar, red cedar, red gum, redwood, sap gum, yellow pine, walnut, white pine

In ordering pine, mill run, kiln dried will be found suitable for carpentry, while short, select, kiln dried, 4 in. and wider or No. 1 shop common, kiln dried will be required for cabinetmaking and patternmaking

Hardwood, for furniture, should be specified first and second grade, kiln dried, standard widths and lengths, or short lengths

MOLDINGS

NAILS
- *a*) Common, 6d, 8d, and 10d
- *b*) Flathead, ½ in. No. 20, ¾ in. No. 19, 1 in. No. 18, 1¼ in. and 1½ in. No. 16, and 2 in. No. 14
- *c*) Finishing, 4d, 6d, and 8d

OIL
- *a*) Linseed, boiled
- *b*) Linseed, raw
- *c*) Machine
- *d*) Rubbing

OVERLAY CARVINGS

PANEL OR PLYWOOD — 3 ply, 5 ply, and 7 ply

PATTERN LETTERS

PINS — escutcheon

PUMICE STONE — No. 0

RAPPING PLATES

ROTTENSTONE

SANDPAPER — Garnet cabinet paper, 3/0, 2/0, 0, ½, 1
Garnet finishing paper, 6/0, 4/0
Garnet paper can also be obtained in rolls of 50 yd. in widths 4 in. up to 48 in. Narrower widths on special order

SCREW EYES

SCREWS
- *a*) Flathead, brass, No. 3 by ⅜ in., No. 4 by ½ in., No. 5 by ⅝ in., No. 5 by ¾ in., No. 6 by ¾ in., No. 7 by ⅞ in., No. 8 by 1 in., No. 10 by 1¼ in., No. 10 by 1½ in., No. 12 by 1¼ in., No. 12 by 1¾ in., No. 10 by 2 in.
- *b*) Flathead, bright, No. 3 by ½ in., No. 4 by ½ in., No. 6 by ¾ in., No. 7 by 7⅞ in., No. 8 by 1 in., No. 10 by 1 in., No. 8 by 1¼ in., No. 10 by 1¼ in., No. 14 by 1¼ in., No. 10 by 1½ in., No. 12 by 1½ in., No. 10 by 1¾ in., No. 12 by 1¾ in., No. 10 by 2 in., No. 12 by 2 in., No. 14 by 2 in., No. 12 by 2¼ in., No. 14 by 2¼ in., No. 14 by 2½ in.
- *c*) Oval head, brass, No. 5 by ¾ in., No. 6 by ¾ in., No. 7 by ⅞ in., No. 8 by 1 in., and No. 10 by 1¼ in.
- *d*) Roundhead, blued, No. 3 by ⅜ in., No. 3 by ½ in., No. 5 by ¾ in., No. 6 by ¾ in., No. 7 by ⅞ in., No. 8 by 1 in., No. 10 by 1¼ in., No. 10 by 1½ in., No. 12 by 1½ in.
- *e*) Roundhead, brass, No. 3 by ⅜ in., No. 4 by ½ in., No. 4 by ⅝ in., No. 5 by ¾ in.

SHELLAC
- *a*) Orange, cut 4 lb. to the gal.
- *b*) Sticks, assorted colors
- *c*) White, cut 4 lb. to the gal.

NOTE: Shellac should be kept in glass or earthenware containers

STAINS — oil, spirit or water. Fumed oak, dark oak, golden oak, light oak, mahogany, and walnut

STEEL WOOL — No. 0 and No. 2/0

TURPENTINE

TWINE

VARNISH — coach, flat, remover, spar, and rubbing

WASTE — cotton, white

WAX — bees and finishing

WHITE LEAD

CARTER HEAVY DUTY OVERARM ROUTER

A Safe, Practical Machine for Routing and Shaping Wood — Plastics — Soft Metals

The Carter Overarm Router is particularly well adapted to today's school shop needs. It handles essential operations in the standard and newer materials that industry is using.

In the aviation industry Carter Tools are used for routing and shaping plastics and plywood. Workers in aluminum and other soft metals are using them for a wide variety of trimming and "clean-up" operations. In shipbuilding and woodworking shops Carter Tools are eliminating hand operations at a great saving in time.

The Carter Overarm Router (illustrated) is a high-speed, heavy duty model. It is powered by a 1 H. P., 18,000 R. P. M. Universal Motor and operates without vibration, producing smooth, clean cuts that require no hand sanding.

The insert at the right shows the same motor unit that is used in the Router, in use as a Shaper. Here again, the powerful motor turning at 18,000 R. P. M. assures clean, accurate work.

SAME MOTOR USED IN SHAPER

Motor Holder tilts 45° either way. Shaper cutters can be used singly or in combination for a wide variety of cuts.

SAME MOTOR FOR PORTABLE ROUTER

Light and easy to handle – can be taken to the work and used in close quarters. Used as shown with base and guide for grooving, paneling and decorative finish on furniture projects. Other attachments available so that same motor can be used for beading and fluting, surfacing and other applications.

1 H.P. Universal Motor 18,000 R.P.M.

SPECIFICATIONS OF NO. ORS5A-1 COMBINATION ROUTER AND SHAPER

Table — 24" x 35"
Throat — (from bit to yoke) 20"
Vertical Adjustment of Motor — 2"
Maximum Height — (table to chuck) 14"
Shaper motor tilts either way
Shipping Weight 450 lbs.

CARTER TOOLS

R. L. CARTER DIVISION
THE STANLEY WORKS
112 ELM STREET, NEW BRITAIN, CONNECTICUT

MEN TRAINED WITH

SKILSAW TOOLS

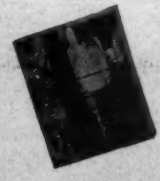
ARE PREFERRED in INDUSTRY

...because industry prefers SKILSAW TOOLS!

SKILSAW DISC SANDERS—Speed up all grinding, filing, sanding and polishing on flat or curved surfaces of all materials. 6 MODELS.

It's just good sense to train new workers with SKILSAW TOOLS . . . the tools they'll find preferred in aircraft, tank and war plants everywhere! That way your students will make the shift to real production *easier* . . . reach peak output *quicker*. And they will learn faster . . . do perfect work sooner with these tools that are proved in industry itself.

SKILSAW TOOLS are lighter, more compact, more powerful. They're perfectly balanced for easier handling, easier learning. Ask your dealer to demonstrate SKILSAW TOOLS *today!*



Send for this New Free Catalog

containing handy Maintenance and Operation Manual. Full of valuable information that will help you do a better job of teaching new workers how to use and care for portable electric tools.

SKILSAW, INC., 5035-A Elston Ave., Chicago 30, Ill.
Sales and Service Branches in All Principal Cities

SKILSAW DRILLS—Light, compact, powerful for faster, better drilling on every job from lightest lead holes to heaviest reaming. 23 MODELS.

SKILSAW BELT SANDERS—For all "final-finishing" on flat surfaces of wood, metals, compositions. Belt widths: 2½, 3 and 4½ inches. 4 MODELS.

SKILSAW PORTABLE ELECTRIC TOOLS

★ MAKE AMERICA'S HANDS MORE PRODUCTIVE ★

PROPER RODS FOR WELDING JOB

E. H. Turnock*

Application	A.W.S. A.S.T.M. Specification	Nema Class	a.c. or d.c. welding	Westinghouse Flexarc
All purpose steel welding where bare electrode is satisfactory. All position	E4510	Bare Class A Standard and Thinly Coated Class B	d.c. only	Grade 18 Sulcoat
Heavy current down hand, deep groove multiple pass, or horizontal fillet, highest quality welds.	E6020 E6030	Heavily Coated Class C	Both	DR
Fillet position general purpose structural steel fabrication of all types. Use in all positions.	E6012 E6013 E7010		Both	FP
All position welding where highest quality welds are required.	E6010		d.c. only	AP
All position general purpose steel welding. Especially for light sheet-metal work.	E6012 E6013		Both Both	SW SW
Hard surfacing alloy. Deposit work hardens Brinell—320 to 350			Both	Hardentough 2
Hard surface. Severe impact and abrasion. Self hardening Brinell 450-500.			Both	Hardentough 3
Hard surfacing. High hardness impact and abrasion resistant 600 Brinell.			Both	Hardentouch 5
Manganese steel welding.			Both	Nickelmang Coated
Manganese steel welding.			d.c. only	Nickelmang Bare
Cast iron welding where easy machining is necessary.		Ferrous Electrodes for Welding Cast Iron Class F	Both	Free-machine weld
Welding of 18 chrome 8 per cent ni. Stainless steels.		Corrosion and scale Resisting Alloy	Both	Nickelchrome Eight
Welding of 18 chrome 8 per cent ni. steels with Columbium.		Electrodes Class G	d.c. only	Nickelchrom Eight Columbium

*Welding Engineer, East Pittsburgh, Pa.

PERSONAL NEWS

(Continued from page 56A)

schools, Mechanics and Central, Mr. Thomas had charge of the classes at Central High School.

Shortly after World War I, when the Federal Government sponsored rehabilitation programs for ex-servicemen who had been partially disabled, Mr. Thomas negotiated a contract with the Veteran's Bureau for the training of these men at the St. Paul Vocational School. These courses continued for several years. At this time also the vocational school took over the administration of a special school in jewelry manufacturing and watchmaking. Under the guidance of Mr. Thomas the rapid growth of trade instruction led to the construction of a separate building for the trade school. In February of 1923 the new building was ready to be occupied.

The spirit of showmanship which Mr. Thomas infused into his administrative activities served a good purpose in advertising the St. Paul Vocational School.

Mr. Thomas was born at Mondovi, Wis., but spent most of his youth at Eau Claire. He attended Stout Institute at Menominee. During World War I he was with the Minneapolis Steel and Machinery Co., now known as the Minneapolis-Moline Power Implement Co. Later he was service manager for the Staude Mfg. Co.

He is survived by his wife, two sons, and two grandchildren.

♦ PAUL G. HAUSMAN, assistant professor and head of the department of practice, School of Engineering and Architecture, University of Kansas, will supervise a U. S. Naval Training Program for Electrician's Mates.

For the past 17 months Prof. Hausman has been supervising vocational training for war service programs at the university. Over 5000 men and women have been trained in the department for the U. S. Signal Corps, U. S. Navy Machinists' Mates, Aeronautical Technicians, U. S. Navy V-12 and Civilian engineering students.

Mr. Hausman formerly taught industrial arts in the Sprinfield, Mo., Public Schools; in Kansas

(Continued on page 78A)

Filing Hints to meet war-time needs

HELLER MADE IN U.S.A. ZDUDH

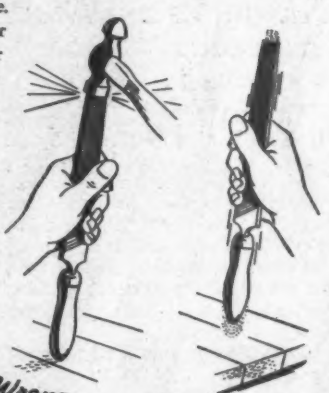
Don't POUND TANG INTO HANDLE

A FILE should always be fitted with a handle. It is then easier to use. However, after selecting the proper handle, do not hammer the file in order to drive the tang into the handle. Merely slip the tang into the hole, and then tap the handle on the bench until the tang is firmly seated.

Handles come in several different sizes,— from the smallest for accommodating a 3" to 6" file to the largest size for a 16" to 20" file. Handles are made from seasoned white birch, coated with shellac, and fitted with a strong spun brass ferrule as a protection against splitting.

☆ ☆ ☆

Providing NUCUT Files with patented "Wavy Teeth" is more costly than cutting merely the ordinary double-cut or single-cut teeth. But it makes possible significantly superior file performance.



Wrong: Never use a hammer to pound the tang of a file into its handle. This is apt to mar or even break the file.

Right: Slip tang into hole in handle. Then tap lightly on the bench until tang is firmly seated.

HELLER BROTHERS COMPANY • Newark, N. J. • Newcomerstown, Ohio

America's Oldest File Manufacturers—Good Tools Since 1836

Awarded to the Newcomerstown, Ohio, Plant

HELLER NUCUT WAVY TEETH FILES

PATENT No. 2027039

TRAINING in SHEET-METAL WORK

for today's immediate needs . . and tomorrow's opportunities

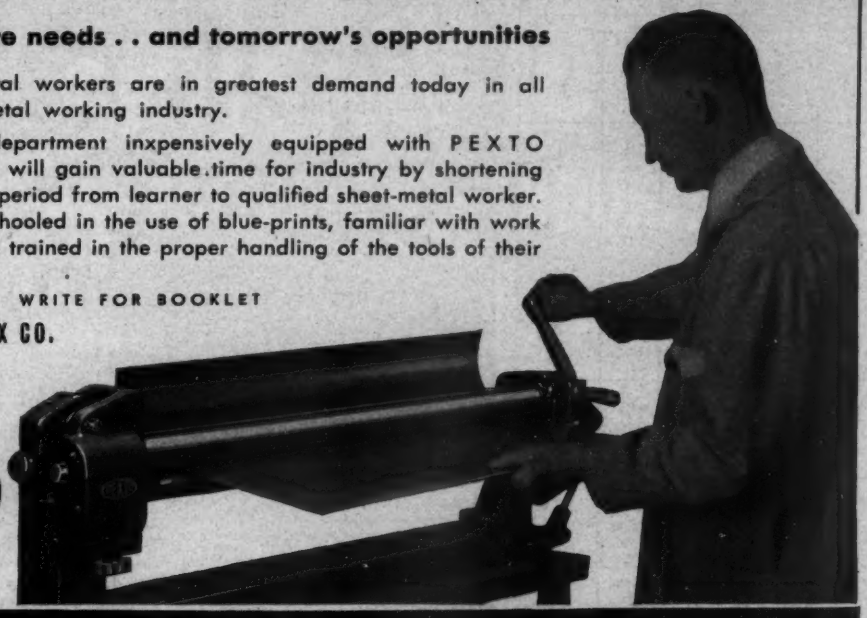
Skilled sheet-metal workers are in greatest demand today in all branches of the metal working industry.

A sheet-metal department inxpensively equipped with PEXTO Machines and Tools will gain valuable time for industry by shortening the usual transition period from learner to qualified sheet-metal worker. Such men will be schooled in the use of blue-prints, familiar with work layout practices and trained in the proper handling of the tools of their trade.

WRITE FOR BOOKLET

THE PECK, STOW & WILCOX CO.
Southington, Connecticut

PEXTO
SINCE 1795



SHEET-METAL WORKING Machines and Tools

TRUE LENGTH OF LINE MODELS

W. W. STURTEVANT

South High School
Minneapolis, Minn.

In a type of drawing much used by sheet-metal workers the draftsman lays out a pattern of such a shape that it will produce the object desired when bent or folded in the correct way. The laying out of such a pattern is called developing the surface of the object. The development is made by finding the true sizes and shapes of the different surfaces of the object and drawing them in the proper relation to each other.

In nearly every course in mechanical drawing some time is devoted to teaching something about developments.

This type of drawing has much to recommend it. Drawing of developments makes the pupils think, develops the ability to visualize, makes for an appreciation of the value of accuracy, gives the boy an opportunity to apply what he knows of projection, and illustrates the practical value of the type of drawing used by the sheet-metal worker.

The two most common causes of error found in these drawings are due to failure to identify the different lines and failure to obtain the true length of lines which do not appear in their true length on the drawing because of the fact that these lines represent surfaces or edges that slope toward or away from the observer.

The first difficulty, that of correctly identifying the lines of the drawing on the different views, may be avoided by having the student number or letter these lines.

The second problem, that of finding the true lengths of sloping lines, causes more trouble. The true length is the hypotenuse of a right angle triangle, the base of which is obtained by measuring the top view, and the altitude of which is found in the front view.

This is often difficult for the student to understand and it is worth while for the instructor to construct a paper model similar to those shown in the accompanying illustrations. These models will often make clear the relation of the slant line to the other two sides of the triangle.

The model for the pyramid and cones shown in Figures 1 and 2, for instance, may be made as follows. Cut out of fairly stiff paper the development of the sides of the pyramid or cone and paste the edges together. Cut out the base of the pyramid or cone,

(Continued on page 66A)

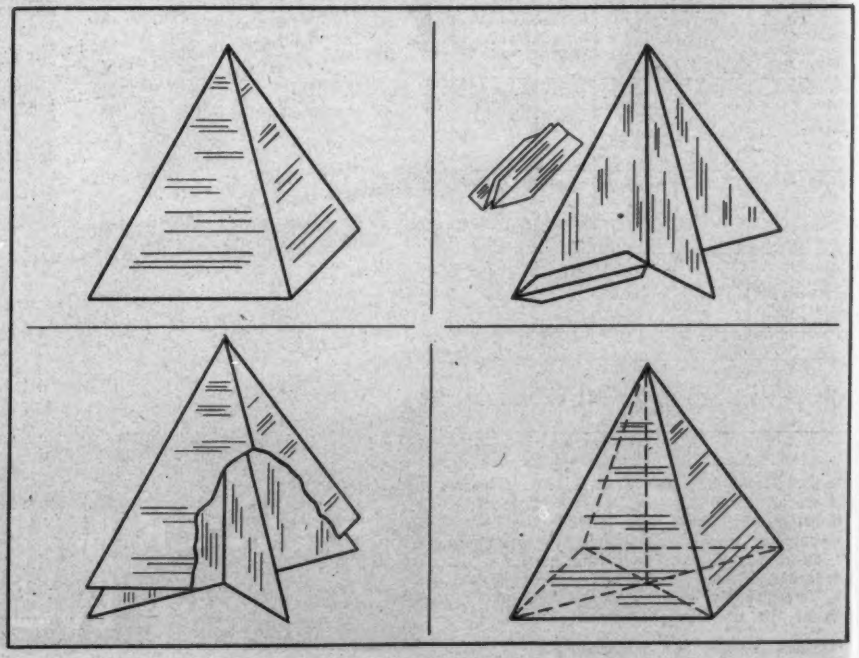


Fig. 1. True length of line models

Are Your Students Familiar with these MODERN PORTER-CABLE MACHINES?

With postwar design emphasizing new materials and advanced techniques, it becomes doubly important to make sure that instruction does not lag behind with pre-war machines. The Porter-Cable units shown here are the last word of PROVED efficiency. Give your school, and your students, the benefits of working with the machines that are being enthusiastically adopted by progressive shopmen and industrialists everywhere. Train your students with the machines they will find on the job when they graduate. KEEP YOUR SCHOOL ABREAST OF VOCATIONAL SCHOOL MODERNIZATION, and ready to meet the challenge of the new postwar educational program.

TAKE-ABOUT The Dustless Sander

The world's most popular sander. Perfect balance — instant belt change — dust-free operation — silent chain drive — an extra powerful motor — all help achieve faster, easier, finer sanding. Give them the machine that gives their work a craftsman's finish.

Speedmatic Saws

Their scientific design makes for perfect balance, eliminating arm strain and cramped muscles. The higher efficiency of the helical gear provides power to spare. The blade enters the cut at 7,000 revolutions per minute — so fast it practically feeds itself. No overloading — no stalling.

Porter-Cable G-8 Wet-Dry Belt Surfacer

Where precision finishing is required, surfacing can be held to an accuracy of .0005" or less for flatness. Most jobs are done free-hand, or with simple fixtures. In most cases, a single presentation to the fast-cutting, diamond-hard abrasive belt gives a dead-flat, glass-smooth finish to plastics, metals, compositions. The coolant eliminates heating, discoloring, warping, dust. The belt is washed constantly, thus kept free of grits and at high-cutting efficiency.

Speedmatic Floor Sanders

A favorite with floor contractors and operators. Its balanced high-speed drum, its extra-powered motor, its easy, feel-of-the-floor adjustment, its high-vacuum dust collection, make Speedmatic out-perform all the others.

Porter-Cable B-6 Wet-Dry Belt Surfacer

Designed for irregular or curved work, its flexible abrasive belt, wet or dry, follows the contours and produces an even, uniform finish. Adjustable backing plate for flat or uniformly curved surfaces.

Porter-Cable G-4 Belt Surfacer

With adjustable position (either horizontal or vertical), this model is recommended for finishing small parts. Many light milling and grinding operations done without fixtures. Popular for second operation work. Used in many toolrooms. Slotted table adjustable up to 45°, for machining angled surfaces.

Send for Complete Literature on These Important Production and Maintenance Machines . . . Check Your Request and MAIL COUPON TODAY!

PORTER-CABLE Machine Co.

1702-3 N. Salina Street, Syracuse, N. Y.

Please send me without obligation descriptive matter on Porter-Cable machines indicated below.

☐ Wet-Dry Belt Surfacers ☐ Speedmatic Floor Sanders
☐ Take-About Sander ☐ Speedmatic Saws

School .....

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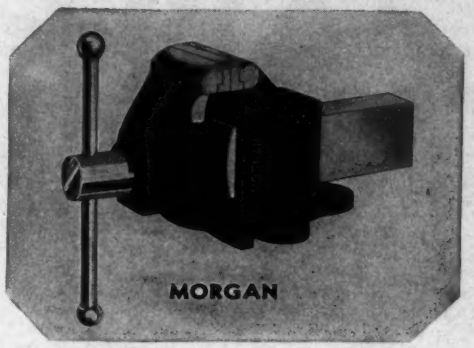
USE THE VISES THAT INDUSTRY USES

MACHINIST VISE

Unsurpassed for strength and durability. Supplied with stationary or swivel base in various sizes.



CONTINUOUS SCREW AND QUICK ACTION VISE

Designed and built to withstand the most severe service. The extra heavy Cold Rolled Screw and Solid Bronze Nut will last a lifetime. Also furnished with steel handles.

Morgan Vises represent more than a quarter of a century of experience in manufacturing vises. Made of quality materials and exacting workmanship, these vises are ready and able to give the utmost in industry and school shops for wartime service.

THE MORGAN VISE CO.

120 N. Jefferson Street Chicago, Illinois

Morgan semi-steel vises will give you years and years, of unbroken, satisfactory service. Thousands of schools throughout the country are using Morgan vises as standard industrial-arts equipment. That is why, too, their shops are more economical and more efficient.

(Continued from page 64A)

and by folding small pieces of paper and pasting them onto the base, make a slot or groove to hold the base of a paper triangle showing the true length of the side.

Several of these triangles may be made and slipped into the slots in the base. The top of the pyramid is then placed over the base and the model is ready to show the class. After explaining that the true length of the line is the hypotenuse of the right angle triangle, the top of the pyramid may be lifted off and the pupils allowed to see these triangles.

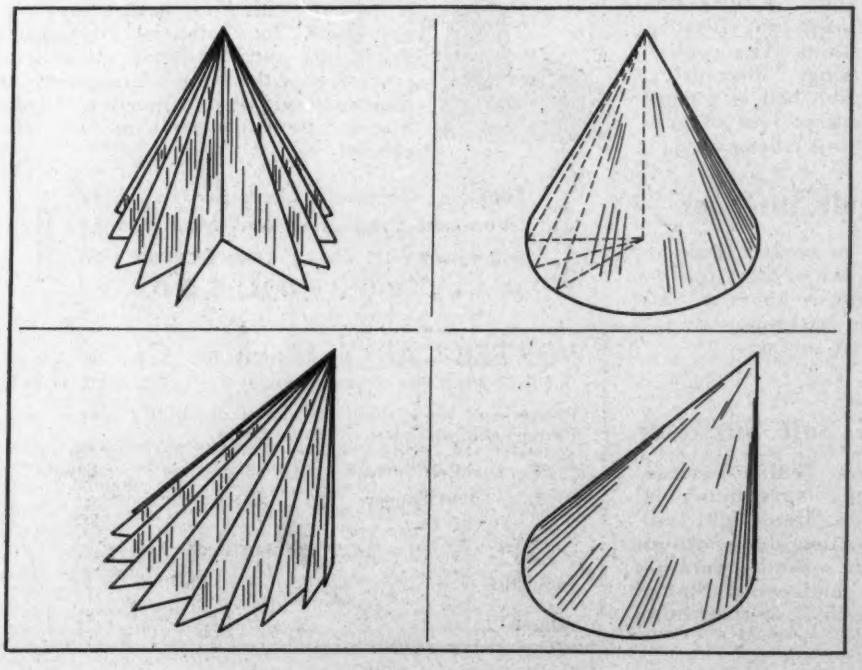


Fig. 2. True length of line models

TEACHING SPEED IN MECHANICAL DRAWING

GEO. W. HAAS

Glenbard Township High School
Glen Ellyn, Ill.

The expression of ideas by the use of symbols is as old as recorded history. In modern times we have a number of these forms of expression, among them handwriting, typing, and shorthand, in addition to that form used by draftsmen — orthographic projection. In all forms of expression it is desirable to express ideas clearly in the shortest possible time. For this reason, teachers of writing, typing, and shorthand devote a good share of their time and effort to have their students develop speed as well as accuracy in their work. It ought to follow that in the field of orthographic projection, speed should be considered as of equal importance with accuracy and clearness. As a matter of fact, our engineers and industrial draftsmen do recognize the importance of speed in drawing, and the lack of that speed constitutes the chief criticism of graduates of high school drafting courses. All teachers of drafting undoubtedly recognize the importance of speed, but how many of us have really made an effort to teach speed as an end in itself?

Let us look at the most common operations performed in the making of a drawing. The equipment most frequently handled consists of T square, triangles, scale, and pencils. Other equipment is used less frequently, but not to the extent which justifies its inclusion in this discussion. The most frequent operations performed are measuring with the scale, and drawing horizontal and vertical lines. The

(Continued on page 70A)

THEY FIT MORE JOBS IN INDUSTRY

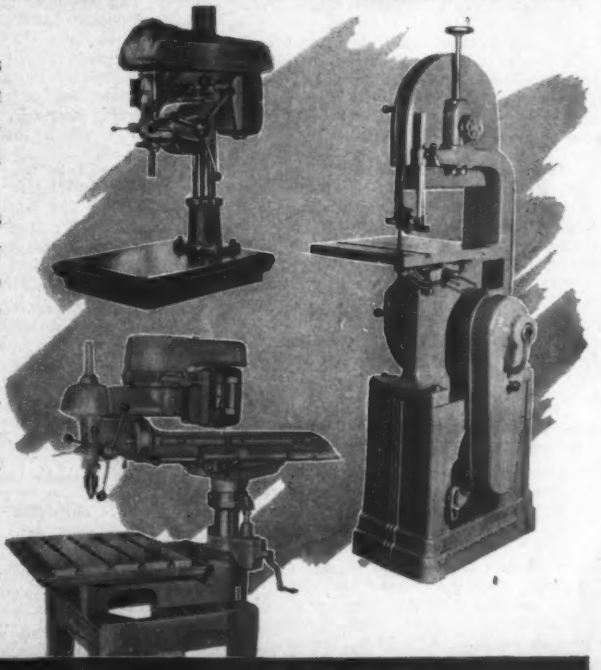
WHEN TRAINED ON WALKER-TURNER MACHINE TOOLS

STUDENTS trained on Walker-Turner Machine Tools aren't "square pegs" or "round pegs" fit for only a relatively few spots in Industry. They have a background built on versatile machine tools that are used *throughout* Industry.

Moreover, Walker-Turner Machine Tools possess several features which make them ideal for training "green" hands. They are easy to operate, simple to understand, ruggedly built to stand up under long hours of inexperienced handling, and fully safeguarded.

For fast, thorough, versatile training, Walker-Turner Machine Tools can't be beaten. At prices within easy reach of your school budget, they are promptly available for war production training. Send for latest catalog

WALKER-TURNER COMPANY, INC.
1934 Berckman Street **Plainfield, N. J.**



walker-turner
COMPANY, INC.
PLAINFIELD, N.J.
U.S.A.

MACHINE TOOLS

DRILL PRESSES — HAND AND POWER FEED • RADIAL DRILLS
METAL-CUTTING BAND SAWS • POLISHING LATHES • FLEXIBLE SHAFT MACHINES
RADIAL CUT-OFF MACHINES FOR METAL • MOTORS • BELT & DISC SURFACERS

Shop Equipment News

New Products — Publications

NEW CABINET FOR HAND-LEVER PRESS

The American Type Founders Corporation presents the American Hand-Lever Press Cabinet (E). It is of hardwood construction, with dark green enamel finish. Its top size is 24 by 24½ in., and it is 25 in. high. The cabinet includes a

drawer with compartment for lever press rollers, chase rack for 4 chases, and shelves for paper stock and miscellaneous items. This cabinet serves as a base on which the hand-lever press is mounted.

For brief reference use IAVE—310.

NEW DRAFTING INSTRUMENTS

The Engineering Sales Co., Sheboygan, Wis., has just perfected a new type of dividers and compasses for the use of draftsmen.

The bodies of these instruments are made of black plastic. Each is equipped with an exclusive point aligning feature to bring the points of the dividers, or the point and pencil of the compass, into perfect alignment.

The steel points in these instruments are renewable and the tension on the headspring is adjustable to suit individual preferences.

For brief reference use IAVE—311.

CHARTS SHOWING CUTAWAY VIEW OF OHMITE RHEOSTAT AND RESISTOR

Two charts for teachers, students, technicians, and engineers in war training have been made available by the Ohmite Manufacturing Company of Chicago.

One is an enlarged reproduction of the cutaway view of an Ohmite close control rheostat, showing its design and construction features. The other is an enlarged cutaway view of a typical Ohmite wire-wound vitreous enameled resistor.

The two wall charts, 25 by 21 in., are available without charge to schools, training centers, and engineers who write for it on official stationery.

Ohmite Manufacturing Company, 4835 Flournoy Street, Chicago 44, Ill.

For brief reference use IAVE—312.

WANTED: 100 USERS OF TRANSPARENT PRINTS

To reduce the time element between the pilot stage and large scale production of a badly needed product, The Frederick Post Co. wants 100 users of Transparent Ammonia developed prints to confirm or disprove the laboratory and limited field tests of what appears to be a full step forward in this field.

The new Transparent, ammonia process, VAPO-vel has just passed months of testing for fading, keeping quality, stability of image and background, printing and developing speed, sharpness of image and the ability to pick up both strong and delicate detail.

Trial quantities will be furnished without charge with the understanding that a detailed report will be made on the results of the tests.

Those who wish to make these tests should write The Frederick Post Co., Box 803, Chicago 90, Ill.

For brief reference use IAVE—313.

WOOL-TEX SPONGES

As a substitute for the hard-to-get natural sponge, the Wool-Tex Sponge Co., 368 E. 45 St., Brooklyn 3, N. Y., announces that it can supply Wool-Tex sponges, made from woolen cloth in the shape of a small pillow.

Wool-Tex sponges are made from cloth containing long fibers, absorb water quickly, are soft when wet or dry, are easily cleansed and dry quickly, last longer than natural sponge, fit snugly into the palm of the hand, and can be used wherever a sponge is needed.

The size is approximately 4½ by 5½ in. Samples, 50 cents each.

For brief reference use IAVE—314.

JUNIOR AVIATION TEACHERS' KIT

To assist the schools with helpful material on aviation, the Piper Aircraft Corporation, Lock Haven, Pa., produced the Piper Teacher's Kit of Junior Aviation Instruction Material.

The kit includes six large wall charts (22 by 34½ in.), prepared by Piper Aircraft engineers and approved by industrial-arts instructors and school superintendents; and also a full-color Piper Catalog and a booklet entitled "You, Too, Can Fly," which explains the basic flight principles.

The material in the kit, while primarily designed for the schools, will prove most helpful and useful to any organization, group, or individual interested in preflight training.

For brief reference use IAVE—315.

NEW DESCRIPTIVE MATERIAL

The Delta Manufacturing Co., 602–634 East Vienna Ave., Milwaukee 1, Wis., have just issued two pieces of descriptive reading matter covering their new Toolmaker and Tool and Cutter Grinder, and their Slo-Speed attachment for 17-in. drill presses.

Both of these interesting four-page descriptions are available to shop instructors who write to the firm.

For brief reference use IAVE—316.

HIGGINS' ART BOOKS

Higgins Ink Co., Inc., 271 Ninth St. Brooklyn 15, N. Y., call attention to the fact that their five-year sales promotion program, which included the publication of five helpful books written by Bert Cholet, was completed in 1943.

The books, "Drafting Standards," "Arts and Crafts Projects," "Script and Manuscript Lettering," and "Techniques," have become very popular, and have done much in making pen-and-ink techniques more widely known and used.

For brief reference use IAVE—317.

CATALOG ON 15-INCH DRILL PRESSES

A new catalog on 15-in. drill presses manufactured by the Boice-Crane Co., 932 Central Ave., Toledo, Ohio, has recently been made available.

The new booklet describes the entire line of 75 models in Boice-Crane 2600 Series Helmet heads and the 1600 Series Drill Presses which include a model for most tooling needs and permits standardizing on one make to simplify and reduce the cost of maintenance.

A section on Boice-Crane Tapping Heads tells how to do light tapping in a rapid, clean, and economical manner.

This new book contains engineering data and suggestions for incorporating Boice-Crane Drill Press heads, parts, and work tables into special machines, and cost reducing, and labor-saving fixtures.

Handy, timesaving accessories also are described.

For brief reference use IAVE—318.

NEW DI-ACRO CATALOG

The O'Neil-Irwin Manufacturing Co., Minneapolis 15, Minn., have just issued the new Di-Acro catalog No. 44–6 which represents a summary of the origin and development of the Di-Acro system of metal duplicating without dies.

This catalog describes the New Radius Brake and Bender No. 3 which have just been added to the list of Di-Acro products and illustrates numerous examples of uses to which the Di-Acro system of dieless duplicating has been applied in the fields of electronic, aircraft, machine tools, and general manufacturing.

For brief reference use IAVE—319.

A BOOKLET DESCRIBING THE DOALL PRODUCTS

The DoAll Service Office, Des Plaines, Ill., is distributing an interesting new booklet entitled "Production Today With DoAll Products." This 36-page booklet shows a complete line of new industrial tools under the DoAll name covering many phases of industrial production. A few of these are DoAll machines, DoAll cutting tools, cutting lubricants and coolant oils, speed controls, precision measurements, and industrial training facilities. Introduced for the first time is DoAll's entry into the field of powder metallurgy with the manufacture of hydraulic presses and powdered metals.

The booklet is well illustrated and briefly defines a number of DoAll products manufactured by Continental Machines, Inc., The Savage Tool Company, The Speedmaster Company, File Bands, Inc., Contour Saws, Inc., The DoAll Company and Alloy Metals Division.

These DoAll products each made by a separate DoAll plant, specializing in their manufacture, offer to industry a new set of tools which will increase production at lower costs, now and in the postwar era.

For brief reference use IAVE—320.

BOOKLET ON COATED ABRASIVES

The Behr-Manning Company, Troy, N. Y., has issued a descriptive booklet on coated abrasives entitled "Basic Information for the User and Buyer." The 28-page booklet presents a clear and concise exposition of the subject of coated abrasives, their component parts, their manufacture, and their ultimate use. It also contains information on how to identify, how to order, and how to store sandpaper. The booklet is copiously illustrated and is available to any instructor who will write for a copy.

For brief reference use IAVE—321.

FIRM SELLS POST PRODUCTS

The Frederick Post Company of Chicago has recently announced that the 20th Century Blue Print Company of San Francisco has taken on the complete line of Post drafting materials, blueprint paper, and kindred sensitized products. This firm also offers a complete blueprint and tracing reproduction service. They are located at 344 Bush St., San Francisco, Calif.

PIONEER GRINDING WHEEL MANUFACTURER DIES

Henry E. Miller, president of the Chicago Wheel & Mfg. Co., died at his Chicago home on Monday, January 10, after a brief illness.

Mr. Miller was born in 1863 on an Illinois farm, became a machinist, and then traveling salesman for the Minnesota Thresher Company. In 1894 he was made manager of the Chicago Emery Wheel Company, which he later purchased. In 1895 he became president and changed the firm's name to Chicago Wheel & Mfg. Co.

(Continued on page 70A)

WACS

WAVES

SPARS

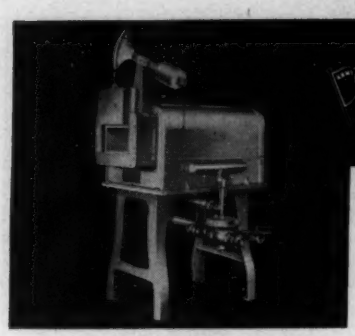
In U. S. Services — At the Four Corners of the Globe — *B-G Men and Women are "In It"*

WE'RE proud of them — just as you're proud of those near and dear to you who are "in it." And while they're in the front lines of battle, we back here at B-G are striving mightily to give them all the help we can in having plenty "on time." The best way we can do that is by supplying schools with all the equipment, machines and supplies they need for training more men and women to make shells, and guns and tanks and bombs — everything our fighters need. And we're doing that to schools all over the Country. If you need some of the things we sell, by all means, send your orders in now.

BRODHEAD-GARRETT Co.

"Supplying Defense Training Needs to Schools in All 48 States"

CLEVELAND • OHIO



Small Semi-Muffle Oven

STEWART

THE BEST INDUSTRIAL FURNACES MADE

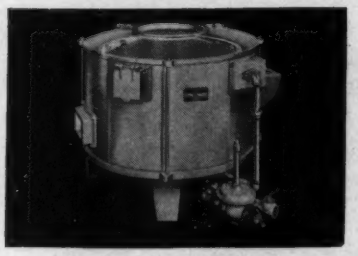
Small Forge

HUNDREDS OF THESE STEWART FURNACES ARE IN THE VOCATIONAL DEPARTMENTS OF TECHNICAL SCHOOLS

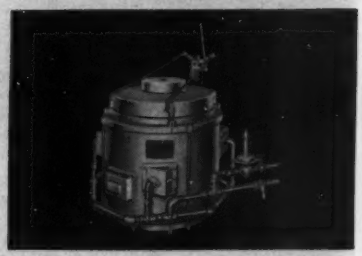
Because Stewart units have been designed for efficient production heat treating in small shops and tool rooms, they are widely recognized as standard equipment for all types of industrial heat treating and vocational training work. For student instruction and reference with further details on Stewart Furnaces especially suitable for school shop use, write for our free "STEWART HANDBOOK of Heat Treating Information and Equipment." Also the new Stewart DATA FILE on school units.

STEWART INDUSTRIAL FURNACE DIV. of CHICAGO FLEXIBLE SHAFT CO.

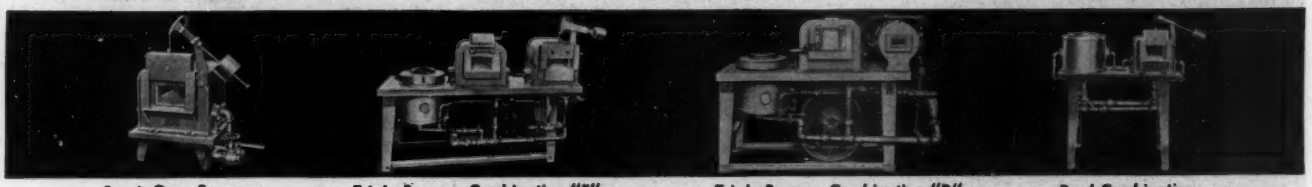
Main Office: 5600 W. Roosevelt Rd., Dept. 129, Chicago 50, Ill.
New York Office: 11 West 42nd St., New York 18, N. Y.



Round Pot Furnace



Melting Furnace



Bench Oven Furnace | Triple Purpose Combination "E" | Triple Purpose Combination "D" | Dual Combination

(Continued from page 68A)

Mr. Miller was one of the founders of the Grinding Wheel Manufacturers Association, and in years of actual experience was one of the oldest men in the industry.

Henry Miller's son, Arthur J. Miller, has been identified with his father in business for many years and will continue to direct the affairs of the company with the same associates, Irving Danielson, vice-president, and Arthur T. Dalton, executive secretary and director of sales.

NEW EASTERN REPRESENTATIVE

Lawrence E. Crosby has been appointed as eastern representative for the American Type Founders Corporation's department of education. Mr. Crosby will assist John A. Backus, manager of the department.

Lawrence E. Crosby

Mr. Crosby comes to ATF with 11 years of experience in the educational field, and in addition, he brings to this new position several years of experience in the direct advertising and printing fields.

Speed in Drawing

(Continued from page 66A)

efficient performance of these basic operations will result in a very noticeable improvement in the speed with which drawings can be made.

Let us consider in detail the use of these common instruments. Watch any high school student draw for ten minutes and you will be struck by the time wasted in turning the scale end for end, looking for the scale he is using, searching for and manipulating his triangle, and handling his T square to get it into the right position. It goes without saying that each instrument should have a specific position when not in use, so that the draftsman can reach for it without looking, if need be. For example, if the scale is placed at the top of the drawing board in the same position as when a measurement is being made, the draftsman cannot only reach for it without looking, but it will always have the correct scale at the lower edge of the upper face. If the triangle is slid along the T square out of the way to the right, it can be moved back without looking, and it will always be in the correct position. These are indeed small things, but if each is performed a hundred times in laying out a drawing, considerable time will be saved by shortening each process only a few seconds.

Another method of saving much time is in the use of the scale. Give a simple drawing problem to a group of students, and see how much difference there is in the number of times the scale is picked up and replaced. If there could be a 30 per cent reduction in the number of times the scale is used, there ought to be a corresponding reduction in the time used. Probably three fourths of the high school students of drawing lay off one measurement with the scale and then draw one line. Surely this is a great waste of time. Any student can keep in mind at least three measurements long enough to mark them all off before drawing any of the three lines. A little practice and thinking along this line will cut in half the number of times the scale needs to be handled, and will reduce materially the drawing time used.

A third way of saving time is in the method of laying out the drawing. A study of the kind of shapes usually encountered in detail drawing will show that most of them are shapes either based on a rectangular block or rounded figures based on center lines. These shapes can be laid out quickly and accurately with a little practice and attention to the order in which measurements are made and the lines drawn. Experience will show that it is often best to lay out the general shape of each view before starting to fill in the details. If the basic shapes such as holes, grooves, cylinders, and the like, are first drawn on the view showing the shape, and then projected to the other views, much time and measuring will be saved. Observation will show that too many students have fallen into the habit of completing one view before starting on another. This is often due to the fact that too much of the average drawing course consists of copy work. The methods and statements just mentioned are commonly found in almost every drawing. The point of repeating them is that the average drawing course has in it nothing to make it necessary for the student either to learn or use them. Psychologically we cannot expect students to learn or practice methods which require extra thought and effort if we

(Continued on page 74A)

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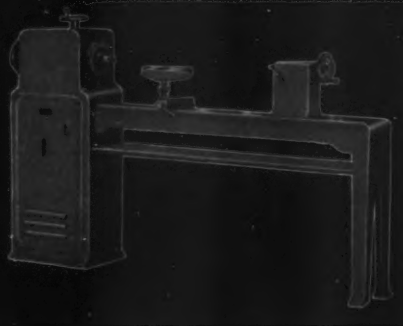
WOODWORKING MACHINERY

. . . Your "BEST BET" because they're built for INDUSTRY . . .

Vocational training for industry must of necessity be sufficiently realistic to be practical. When you train students on Crescent Woodworking Machines you are providing them with actual shop experience. Like the Crescent machines that they might be called upon to operate in industry, those illustrated at the right are ruggedly constructed, easy and safe to operate, and accurate. Thousands of them are doing production line duty and are proving themselves capable of almost any production requirement.

The many new applications of wood and wood products are opening many new possibilities for broader vocational training. Anticipate your peacetime program now and let Crescent help you plan your new, modern school shop. Write for Crescent's new catalogs and literature describing the complete line of Crescent Woodworking Machinery.



Planers, Band Saws, Saw Tables, Borers, Mortisers, Lathes, Disk Sanders, Cut-Off and Variety Saws, and Shapers.

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MACHINE COMPANY
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Huther Bros. Saw Mfg. Co., Inc.

1290 University Ave., Rochester, N. Y.

Manufacturers of

Circular Saws, Groovers, Band Saws

Huther Bros. Saws are the result of more than sixty years' successful and uninterrupted experience in the manufacturing of saws. Each saw embodies the highest type of workmanship and is backed by a guarantee to be as free from flaws and seams as possible. Complete catalog on request.

Dado Head

Our dado head developed from our own patents cuts grooves with or across grain, smooth, sharp sides, grooves from ⅛" up to 4" and over. Easily adjustable. Consists of 2 outside Cutters ⅛" thick and inside cutters to make desired cut. Inside cutters in 1/16", ⅛" and ¼" thicknesses. These Groovers make a perfect cut and leave the bottom smooth.

Saw Vise

Setting Stake

These are useful articles for the filing room and were both developed for use in our own filing department. Vise is easily adjusted for various bevel filing and takes saws up to 18" diameter.

High Speed Knives

Shaper Stock, Ground Flat Stock

We manufacture thin High Speed Steel Knives, Solid Moulder Knives from High Speed Steel or Special Laid Steel. We can also furnish ground stock in various thicknesses and widths, square edges, in High Speed or best quality Tool Steel.

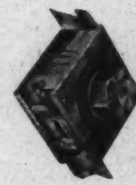
Band Saws

We make both wood and metal cutting band saws, also special temper saws for fibre, bakelite and soft metals. Let us know what you cut and we can furnish a saw for the purpose.

Inserted Tooth Groover

This is the perfect Groover for end grain cuts in hard wood. Teeth are High Speed Steel, front to back clearance, and require grinding on top only. Cuts full width groove through life of teeth. Teeth can be replaced.

Cutter Heads for Saw Mandrel



Cutter Heads for use on saw table. These heads can be furnished with variety of knives and used for jointing and running light moulding on saw table. Made in 6" diameter, 2¼" wide. Can be counterbored if necessary.

Mitre Saws

Our Mitre Saws are accurately ground with the proper side clearance and are made in six styles of tooth shape. Cleaner Tooth Saws are for both rip and cross-cut—made in diameters from 4" to 24".

Huther Bros. Saw Mfg. Co., Inc., 1290 University Ave., Rochester, N. Y.

News Notes

♦ Those interested in postwar jobs will find helpful information in a 6-page leaflet on "The Occupation of the Automobile Salesman," by Clare A. Costello, published by Occupational Index, Inc., at New York University, New York 3, N. Y. Single copies, 25 cents cash with order.

♦ A new 33-frame slide film on the proper techniques for using the S.V.E. Slide Binder has been announced by the Society for Visual Education, Inc., 100 East Ohio Street, Chicago 11, Ill. It will be furnished free to those in charge of visual instruction departments or courses, and to others who are using the binders regularly.

♦ A new catalog of technical books has just been issued by The Chemical Publishing Co., Inc., 26 Court St. Brooklyn 2, N. Y. This catalog includes the latest books on chemistry, technology, physics, general science, mathematics, engineering, radio, aviation, foods, formularies, cosmetics, gardening, medicine, metals, technical dictionaries, and the like. It gives the date of publication of each book as well as a concise description and full table of contents.

♦ Counselors, deans, advisers, placement officers, librarians, teachers, parents, and students, who want to know more about postwar jobs, will find helpful information in a series of Occupational Abstracts, covering 10 occupations in which the experts expect employment to increase at just about the time when returning soldiers and dismissed warworkers will be looking for new jobs.

Each abstract will cover postwar employment prospects, nature of the work, abilities and training required, entrance and advancement, earnings, number and distribution of workers, advantages and disadvantages, and sources of further information.

For further information, address Occupational Index, Inc., New York University, 87 Washington Square, New York 3, N. Y.

♦ The State Board of Education, Atlanta, Ga., has approved plans to set up three state trade schools and is seeking to use $100,000 of its own funds to help start immediate operations in one or more of these schools.

In addition to the three state schools, the board voted to set up and develop a number of area trades and industrial schools over the state — at no cost to the state other than the small amount paid for schools doing similar work.

It also launched a program to enlarge agricultural and industrial-arts training in local schools — at no additional expense to the state.

Specific locations for the three state schools were not selected by the board, although one is to be located in north Georgia, one in central Georgia, and one in south Georgia. Only two applications have been made for the schools. One from Clarkesville, where there is a half-million-dollar abandoned NYA project ready to be transformed into a state trades school; the other is from Milledgeville, which offers the facilities of the old state prison buildings.

♦ The Society for Visual Education Aircraft Identification Kit, which was prepared by the aviation experts on the staff of *Flying*, is being kept up to date by the addition of new aircraft silhouettes as rapidly as information becomes available. Silhouette slides of five aircraft were announced in September, and there are now silhouettes of five additional aircraft available. These include the following: 118. Lockheed Hudson (A-39, PBO); 119. Boeing Sea Ranger (PBB); 120. Heinkel He-113; 121. Heinkel He-115; 122. Fieseler Storch (Fi-156K).

There are three silhouettes of each aircraft — bottom, side, and head-on views. These five are numbered 118 to 122 to correspond with the numbering in the kit. Space is provided in each kit for the addition of these silhouette slides.

(Continued on page 84A)

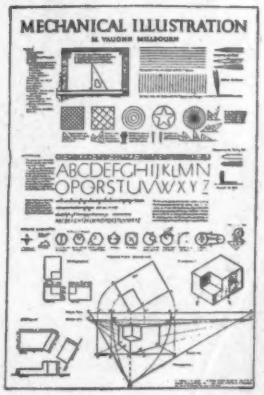
A questionnaire was recently sent to 975 users of drawing ink. Of the 351 replies received, 297 stated that they "found Justrite superior to other drawing inks they had used." Thirty-two stated that Justrite was "as good as any." Thirteen decided that Justrite was not superior to others, and nine did not answer the question. Here is a breakdown by the class of user:

	Justrite Drawing Ink was Superior to Others	As Good As	Not Superior	No Answer
Instructors	131 (85%)	16	4	4
Draftsmen	125 (86%)	10	6	4
Artists	41 (80%)	6	3	1

While over 84% declared it was the best, over 95% of all those replying said that they were going to continue to buy it. If you haven't tried Justrite Drawing Ink as yet, maybe you're missing something!

FREE! Large Wall Chart of Mechanical Illustrations

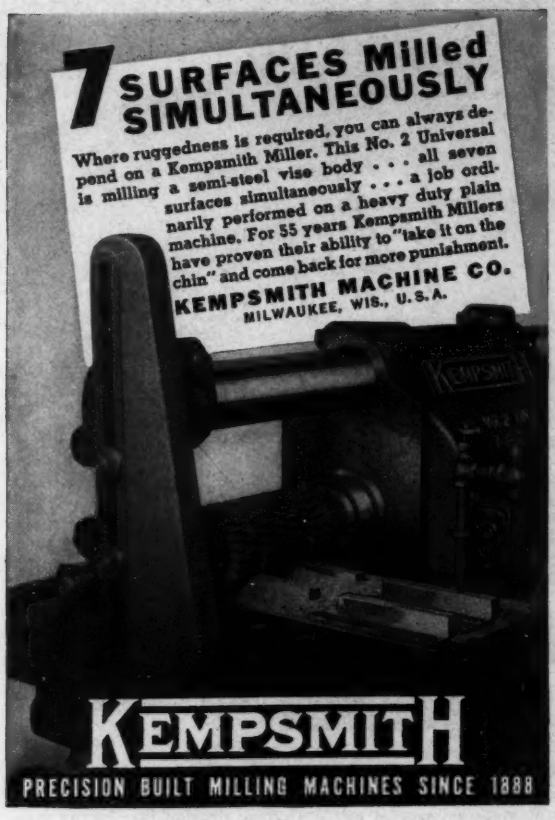
This giant 23x35 inch chart shows many of the elementary steps in mechanical drawing, lettering, applied geometry, and perspective drawing. Write today on your school letterhead. Please mention, also, your drawing ink dealer's name.



For Your Free Chart, Write Dept. BM

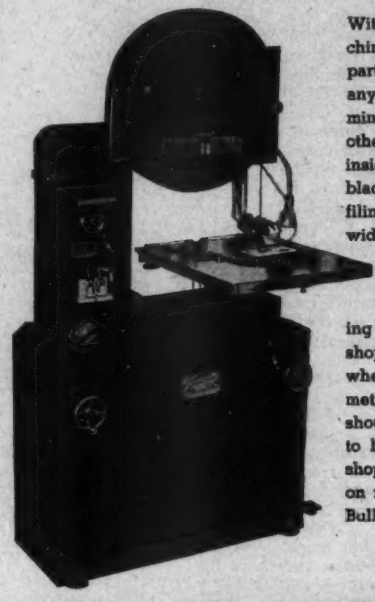
LOUIS MELIND COMPANY

362 W. Chicago Ave., Chicago 10, Ill.


7 SURFACES Milled SIMULTANEOUSLY
Where ruggedness is required, you can always depend on a Kempsmith Miller. This No. 2 Universal is milling a semi-steel vise body . . . all seven surfaces simultaneously . . . a job ordinarily performed on a heavy duty plain machine. For 55 years Kempsmith Millers have proven their ability to "take it on the chin" and come back for more punishment.
KEMPSMITH MACHINE CO.
MILWAUKEE, WIS., U. S. A.
KEMPSMITH
PRECISION BUILT MILLING MACHINES SINCE 1888

Tannewitz DI-SAWS

Most Essential Requirement for Your Machine Shop!



With this extremely versatile machine, tools and dies, machine parts or other items of practically any shape may be made in the minimum of time from steel or any other material; for it provides for inside and outside sawing, using blades 3/32" to ½" wide, chain filing — in three different file widths, and endless belt polishing. Because of this great versatility as well as the fact that these machines are being widely used in machine shops throughout the country where they are obsoleting other methods, a TANNEWITZ DI-SAW should be the number one item to be purchased for your school shop. Complete details furnished on request. Just ask for DI-SAW Bulletin.

THE TANNEWITZ WORKS, GRAND RAPIDS, MICH.

(Continued from page 70A)

do not include in our courses work which makes both thought and effort essential to successful work. Likewise, we cannot teach speed in drawing unless we use some form of speed tests in our teaching.

In the series of speed tests on which this article is based the following procedure was used. The student was given a problem of the type and difficulty of that shown in Figure 1. Three views of the object were required, but no dimensions were placed on the drawing, since the test was for purely mechanical speed. The student was required to draw the views, center them on a 9 by 12-in. sheet, draw a border, and letter the title strip as shown in Figure 2. If desired, the title strip may be omitted, as this introduces the factor of speed in lettering, which can be taught separately. For each test the student was allowed 20 or 25 minutes, depending upon the number of circles, lines, and amount of lettering. The tests were turned in as soon as completed and marked by the instructor with the number of minutes used. The tests were then graded for both speed and quality by the following method.

Let us use Figure 2 as an example. Since 25 minutes was set as the standard time, 100 ÷ 25 or four points are counted for each minute used, adding it for each minute under 25 and subtracting it for each minute over.

(Continued on page 76A)

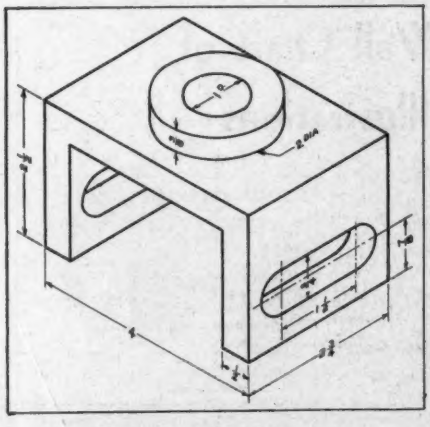


Fig. 1. Isometric sketch of the object

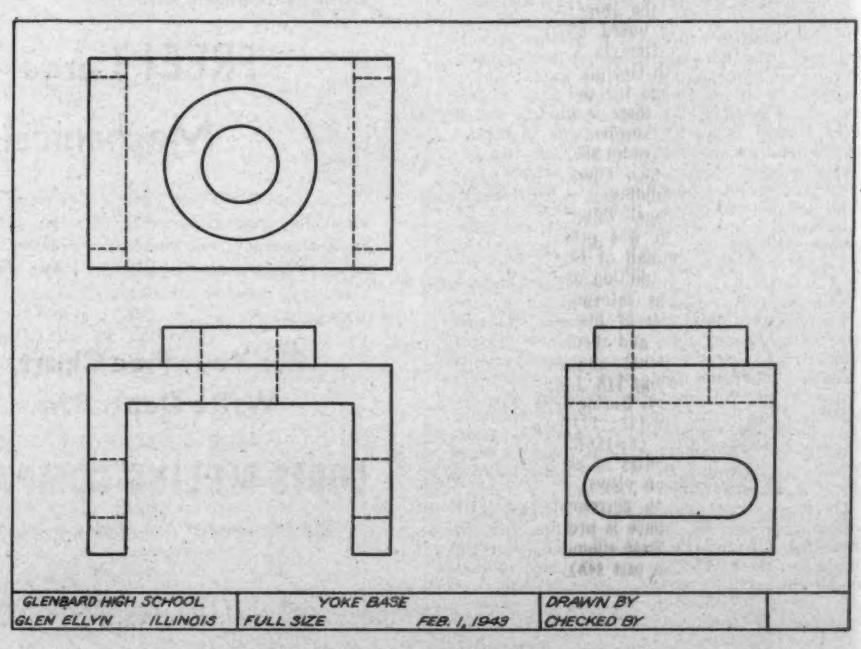


Fig. 2. As the student draws it

In War as in Peace—

We are pleased that so many *International Textbooks* are being used in America's war training effort. That our books so serve is an accurate indication of their scope and content. *Although designed for peacetime use,* they have fully met the requirements of wartime education! *International Textbooks* see service daily in the United States Armed Services institutes, government-sponsored war emergency education programs, industrial training procedures, and in the greatly accelerated school and college specialized instruction courses. In short, *International Textbooks* satisfactorily serve knowledge-seeking people in a progressive nation at war.

After Victory comes, we know that *International Textbooks* once again will assume their broad peacetime duties in the diffusion and dissemination of practical, authentic technical and professional information. *Our record of service will stand firmly!*

Examine This Checklist of Selected INTERNATIONAL TEXTBOOKS

BUILDING TRADES

Building Trades Handbook	$1.00
Carpentry I	2.00
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Carpentry III	2.30
House Planning	1.95
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Plain and Fancy Brickwork	1.60
Practical Electrical Wiring	1.80
The Slide Rule	1.00
The Steel Square	1.50

DRAFTING

Advanced Mechanical Drawing for High Schools	$1.75
Electrical Drafting	2.55
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Engineering Drawing (Second Edition)	3.00
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Exploring the Arts and Industries	$1.60
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Woodworking for Everybody	2.00
Woodworking Through Visual Instruction	1.50

MACHINE SHOP

Gear Calculations and Making	$1.80
Mechanic's Handbook	1.00

MATHEMATICS

Arithmetic I	$1.50
Arithmetic II	1.00
Arithmetic Tables and Formulas	1.25
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INTERNATIONAL TEXTBOOK COMPANY

Scranton (9), Pennsylvania

BOICE-CRANE SAFETY-ENGINEERED PRECISION-BUILT SHOP-TESTED POWER TOOLS

MAKE ROOM FOR MORE TRAINEES • EFFECT QUICK SHOP EXPANSION • ASSURE SAFETY FOR INEXPERIENCED HANDS • AVAILABLE NOW

BOICE-CRANE No. 1000 12" x 4" THICKNESS PLANER

• Positively turns out work as fine as larger costly machines. Built just like a big machine, not cheapened in any way and with no essential parts eliminated. Takes abuse of continuous heavy cutting.

Planes the hardest, also the brashy "splintery" varieties of wood down to veneer-like thicknesses (1/16") so smoothly that an absolute minimum of sanding is required, and stock as short as 6½", keeping huge amounts of material from the scrap heap. Saves money by reducing the number of stock sizes needed.

The extra strong, heavy one-piece frame construction, gives smoother, quieter operation and longer life.

Oversize table lifting screws. Large, long wearing gears and ball thrust bearings.

Two idler rolls, mounted on adjustable journals, make the feed steady and powerful. Smooth, positive power-feed without troublesome clutch. Feed pressure, from a feather-weight touch to a bulldog grip, is always within complete control. The feed can be stopped instantly without stopping the power source.

Choice of drives, direct-to-cutterhead, V-belt electric motor drive, or drive from line shaft or gasoline engine. Bench or floor type models.

The largest builders of bench planers in the country, with mass production methods which save you from $50 to $100 per unit.

BOICE-CRANE OSCILLATING SPINDLE SANDER

• Rapid production. Uses smallest diameter abrasive sleeve of any low priced spindle sander. Sands any degree of bevel up to 6 inches in height. Large, tilting work table.

• Under present priority regulation Boice-Crane machines costing less than $100.00 carry an automatic priority under CMP Regulation 5 A.

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BOICE-CRANE COMPANY • 932 Central Ave., Toledo, Ohio

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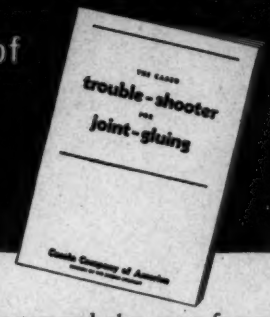
THICKNESS PLANERS • TAPPING MACHINES
SAW JOINTERS • DRILL PRESSES • BELT SANDERS
SPINDLE SANDERS • BAND SAWS • SPINDLE SHAPERS

FREE! "FIRST-AID" GLUING HANDBOOK

For Instructors of Advanced Woodworking Classes



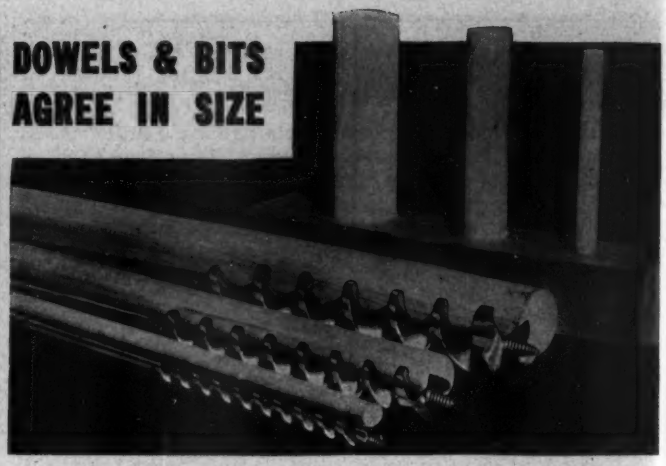
● Written for inspectors and glue-room foremen in industry, the "Casco Trouble Shooter" for joint gluing is helpful as a practical text and reference book for vocational instructors—especially those teaching aircraft woodworking.

Subjects include: How to identify the cause of a poor glue joint; The mechanics of casein and resin glue; Common gluing faults and their remedies; Mixing, spreading, pressing and maturing procedures, etc. 22 pages. Easy to read.

Your copy gladly sent if you request on school letterhead.

CASEIN COMPANY OF AMERICA
DIVISION OF THE BORDEN COMPANY
350 MADISON AVENUE, DEPT. VE 3, NEW YORK 17, N. Y.

DOWELS & BITS AGREE IN SIZE



Accurate Tools Make Teaching Easier

The sizes marked on Russell Jennings Auger Bits *mean what they say!* In the school room this saves time and explanations. Other reasons why it's a joy to work with these bits: the screw is exactly in the center — the lips and spurs are hand-sharpened — the chip clearance and body taper are correct — the steel used insures long edge life. Why not *standardize* on Russell Jennings Auger Bits?

Russell Jennings
AUGER BITS

THE RUSSELL JENNINGS MFG. CO., CHESTER, CONN.

(Continued from page 74A)

There are 41 lines in the drawing, or about 2½ points for each line. Each poor line is checked and 2½ points deducted for each. By a poor line is meant a line not of the correct weight, lacking uniformity from end to end, overrunning lines, poorly made hidden edges, circles and curves not tangent or too light, and lines resulting from other practices considered poor drafting. A test on which eight lines were poorly drawn, and which was completed in 23 minutes, would get a score of 100 minus 8 × 2½ plus 2 × 4 or 88 points. A test on which two lines were poor which was completed in 26 minutes would score 100 minus 2 × 2½ minus 1 × 4 or 91 points. In the first instance it will be seen that had the student used three extra minutes in order to make those eight lines well, his score would have been higher. Considerable experimenting was done before adopting these standards for speed and quality. We believe that this system presents a desired combination of speed and quality. The penalty for poorly made lines must be sufficient to discourage students from sacrificing quality for speed. At the same time, the reward for speed must be enough to make it worth while. This method of scoring encourages students to develop the greatest speed consistent with good quality.

Our students have found that a little practice will enable them to make all types of lines — compass lines, hidden edges, and straight lines — in about half the time they had previously used without sacrificing quality or accuracy. It has been found that the best way to develop improved technique and procedure is to devote a few minutes after each test to a discussion of the most efficient way of accurately laying out the various parts of the problem just completed.

The series of these tests were given to a class of second-year drawing students during the first semester. The last test given, of a series of six or eight, was the same as the first test of the series. A comparison of the scores showed that on the average there was an improvement of about 20 to 25 per cent in the scores, which shows a decided improvement in speed with no sacrifice of *quality or accuracy*. As a result of this experiment we are convinced that by incorporating such a series of tests in the course of study as regular weekly occurrences, we can better achieve the aim of all drawing courses to learn to make a good drawing quickly and accurately.

New Publications

Aircraft Blueprints and How to Read Them

By Carl Norcross. Cloth, wire binding, 102 pages, 8¾ by 11¼ in., illustrated. Price, $1.75. The McGraw-Hill Book Co., New York City.

A short(intensive blueprint-reading course for those who are working in, or want to work in aircraft manufacturing plants.

The book contains a number of useful industrial blueprints which will help the student to become acquainted with the blueprints he will meet in industry.

The Young Craftsman

Cloth, 224 pages, 6½ by 9½ in., illustrated. Price, $1. Popular Mechanics Press, 200 E. Ontario St., Chicago 11, Ill.

A book of the "How to Make It" type. It contains projects of all kinds — 450 of them — which will gladden the heart of almost any craftsman.

Diesel Locomotives — Electrical Equipment

By John Draney. Cloth, 388 pages, 5¾ by 8⅜ in., illustrated. Price, $3.75. American Technical Society, Chicago, Ill.

A book for students who want to learn, and for mechanics who have to know how to operate and service the Diesel engine. Now that this engine is used more and more in the field of American transportation, operators and maintenance men will be needed in ever increasing numbers. This book is a boon to those who want to enter the field.

Ship Model Building

By Gene Johnson. Cloth, 242 pages, 6¼ by 9¼ in., illustrated. Price, $2.50. Cornell Maritime Press, 241 W. 23rd St., New York 11, N. Y.

A book for the beginner. It contains many fine illustrations and descriptions showing how the various details of the models and their appurtenances are to be constructed.

You and Your Future Job

By William G. Campbell and James H. Bedford. Cloth, 368 pages, 6¼ by 9¼ in., illustrated. Published by the Society for Occupational Research, Los Angeles, Calif.

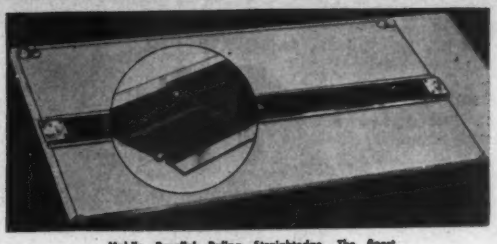
This book covers the occupations commonly found under such major subdivisions as agriculture; industry and trades; building trades; factory work; clerical and financial work; merchandising; domestic, personal, and health service; transportation and communication; government service; arts and crafts; entertainment and writing; the professions; and social work.

There are also chapters on opportunities for women, earning money at home, and jobs for those over forty.

(Continued on page 86A)

PRECISION DRAFTING EQUIPMENT FOR TODAY'S STUDENT

ESCO Plastic Divider with interchangeable points and readjustment feature. An instrument that feels at home in the hand.



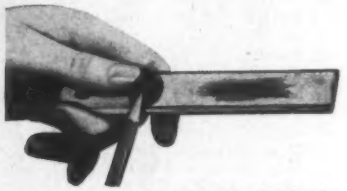
Mobilo Parallel Ruling Straightedge. The finest straightedge obtainable today. Equipped with retractile rollers which prevent smudging of drawing. Every school drafting room should have one of these.

The Ideal T-Square for Professional Engineers and students. Laminated plastic with removable head. All models can be fitted with Swivel type head.

Navigator's Case with ESCO Plastic Compass and Divider. Also contains Screw Driver and Vial with extra leads and points. A useful set for the student and seasoned navigator.

ESCO
Products

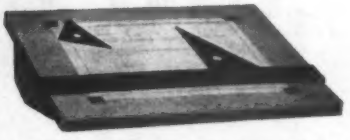
REG. U.S. PAT. OFF.



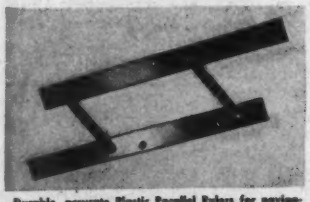
A handy refillable type Pencil Pointer with Felt pad to clean pencil point. Ideal for the classroom.

ESCO provides the student with the finest Drafting and Navigating equipment obtainable.

ESCO qualifies by meeting the exacting requirements of War industries and the Armed Forces.

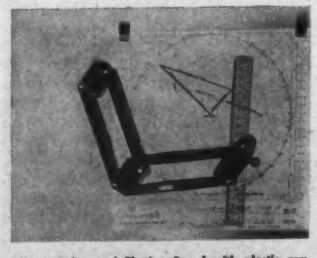


Student Drawing Kit consisting of Drawing Board Formica T-Square, and two transparent plastic Triangles.



Durable, accurate Plastic Parallel Rulers for navigation and other purposes. Used by the U. S. Navy

A leatherette covered Carrying Case designed for our Professional Kit—with pocket for drawings and tracings. A very practical and usable piece of equipment.



Maneuvering and Plotting Board with plastic arm and scale designed by ESCO Engineers and used by U. S. Coast Guard.

Drafting Table: with the ESCO 5-ply top Comes equipped with or without Parallel Ruling Straightedge—sizes 21" x 36" Top through 30" x 42" Also in five larger sizes. Table is adjustable to height.

The ESCO Professional Drawing Kit. Five-ply board, parallel ruling Straightedge, elevating arms, and suction cup feet. Sizes 12" x 14" through 30" x 42".

702 Clara Avenue
SHEBOYGAN, WISCONSIN

ENGINEERING SALES CO.

11 South LaSalle St.
Rm. 1217, CHICAGO 3, ILL.

Print-Shop Equipment

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

BELLOWS
- *a*) Hand, small size
- *b*) Electric, blower type

BLACKBOARD — permanent or portable

BOOKCASE — for reference books, catalogs, etc., sectional preferable

BRAYER — 6 or 8 in. for proofing

BRUSHES
- *a*) Bench
- *b*) Benzine, No. 1, oval black
- *c*) Floor
- *d*) Padding, 1½ in. wide

BULLETIN BOARD

CABINETS
- *a*) Galley, for double column, wood or steel, four tiers (to be used with typesetting machines)
- *b*) Galley, for 8¾ in. by 13 in. galleys, wood or steel, four tiers
- *c*) Ink and roller, to accommodate platen-press rollers, wood or steel
- *d*) Matrix, for use with typesetting machines only
- *e*) Roller, cabinet or rack for cylinder rollers
- *f*) Supply, for leads, slugs, spaces, strip material, with top for lead cutter and mitering machine
- *g*) Type, school type, each to accommodate two California cases, job cases, case slides, galley slide, and copyholder
- *h*) Type, complete with 24 full-size California job cases, with overhead lead-and-slug cases, wood
- *j*) Type, complete with 24 full-size California job cases, double work band, wood or steel
- *k*) Wood or metal, for filing class records, instruction sheets, etc.
- *l*) Storage for cuts

CANS
- *a*) Benzine, pint size
- *b*) Benzine, 5-gal. size
- *c*) Kerosene, safety, 1-gal. size
- *d*) Waste can, fireproof, for rags

CASES
- *a*) Blank, full-size, to accommodate ¼-size cases
- *b*) Border, ¼ size, for ornamental borders
- *c*) Lead and slug, regular size, to hold laborsaving fonts of leads and slugs
- *d*) Metal furniture, to hold laborsaving fonts
- *e*) Rule, ¼ size, for brass rule

CHAIRS — teacher's and tablet arm

CHASE RACKS
- *a*) For platen presses
- *b*) For cylinder presses

CHASES
- *a*) For each size of platen press
- *b*) For cylinder press

COMPOSING STICKS — 6 by 2 in., 8 by 2 in., 12 by 2 in., and 18 by 2 in., adjustable

CUTTER
- *a*) Lead and rule
- *b*) Paper, lever type, 20 in., with pedestal. Should handle 20 by 26-in. sheet
- *c*) Paper, lever type, 26 in. or 30 in.
- *d*) Paper, lever type, 30 in., with divided back gauge
- *e*) 30 in. to 36 in. power cutter

DESK
- *a*) Bindery, 80 by 36 in.
- *b*) Drying rack
- *c*) Imposing, 51 by 39
- *d*) Make-ready, 32 by 24 in.
- *e*) Paper cutters, 80 by 36 in.
- *f*) Proofreaders
- *g*) Teachers

DRYING RACKS
- *a*) Combination drying rack and stock table for platen presses, 30 trays
- *b*) Trays, interlocking, for cylinder press

FOLDING BONES — for hand folding

FOLDING MACHINE — 20 by 26-in. size, 4 fold, two parallel and two right-angle folds, power

FURNITURE — iron, 2 by 4 to 10 by 15 picas

GALLEYS — Steel, 8¾ by 13 in., 6¼ by 23½ in., double column, and 12 by 18 in.

GAUGE PINS — spring tongue

GLUE POT — electric, 1-qt. size

IMPOSING TABLES
- *a*) 12 by 18 in., with iron top, including reglets and furniture
- *b*) 24 by 36 in., with iron top, complete with galley slides, chase rack, reglets, and furniture
- *c*) 36 by 48 in., with iron top, complete with galley slides, chase rack, reglets, and furniture
- *d*) 39 by 63 in., with iron top, complete drawers, letter boards, reglets, and furniture

INK FOUNTAINS
- *a*) Short, for 8 by 12, 10 by 15, and 12 by 18 presses
- *b*) Long, for 10 by 15, and 12 by 18 presses

KNIVES
- *a*) Overlay, for make ready
- *b*) Ink, 6 in. and 8 in.
- *c*) Ink, 8 in., square end

LEADER BOXES

LEADERS
- *a*) 6, 8, and 10 pt., fine dot
- *b*) 8 and 10 pt., hyphen

LINE GAUGES
- *a*) Metal, brass, or steel
- *b*) Wood

MALLET

METAL FURNACE — for recasting and refining type metal, used only with typesetting machines

MITERING MACHINE

NUMBERING MACHINES
- *a*) For use on presses
- *b*) Hand machines

ORNAMENTS
- *a*) Assorted floral and decorative designs
- *b*) Border, 6 and 12 pt., decorative

PAPER-DRILLING MACHINE

PERFORATOR
- *a*) 24 in., foot treadle
- *b*) 28 in., foot treadle

PLANER
- *a*) Mallets, hickory or fiber
- *b*) Proof, maple, with felt bottom
- *c*) Type, maple, with leather top

PRESSES
- *a*) Cylinder, two revolution, four roller, 17 by 22, complete with variable-speed motor, cast rollers, etc.
- *b*) Platen, 8 by 12, with foot treadle, counter, flywheel guard, platen guard, brake, and set of cast rollers (motor and treadle combination if desired)
- *c*) Platen, 10 by 15, complete with variable-speed motor, counter, flywheel guard, brake, and set of cast rollers, etc.
- *d*) Platen, 12 by 18, complete with variable-speed motors, counter, flywheel guard, platen guard, brake, and set of cast rollers, etc.
- *e*) Proof, 14 by 18, with cabinet
- *f*) Proof, 20 by 24, with cabinet
- *g*) Proof, 23 by 24½ with cabinet
- *h*) Tableting

PUNCH
- *a*) Foot power, multiple with assorted punches
- *b*) Lever, two die, with assorted punches
- *c*) Power, multiple, with assorted punches (paper drill may be substituted)

QUOINS
- *a*) Sizes No. 1 and No. 2
- *b*) Keys, Sizes No. 1 and No. 2

RULE — plain and brass (fonts to fit quarter cases)
- *a*) 2 pt., laborsaving, hair line, side face
- *b*) 2 pt., laborsaving, 1 pt. side face
- *c*) 1 pt., laborsaving, 1 pt. face
- *d*) 2 pt., laborsaving, double face

SAW TRIMMERS — pedestal type, with point gauge, and raising and lowering table

SILK-SCREEN UNIT

SPACING MATERIAL
- *a*) Iron furniture, as selected
- *b*) Leads, laborsaving, 2 pt.
- *c*) Leads, 2-ft. strips, 2 pt.
- *d*) Slugs, laborsaving, 6 pt.
- *e*) Slugs, 2-ft. strips, 6 pt.
- *f*) Spaces and quads
- *g*) Thin spaces, brass and copper, assorted sizes, 6 to 8 pt., one size in each box

SPECIMEN DISPLAY BOARD

STAPLE BINDER — pedestal type, foot power

STEREOTYPING UNIT, 8 by 12 in.

STITCHER — wire, power, capacity ½ in. or ¾ in., flat- and saddle-back tables

TWEEZERS — 3½ in.

TYMPAN PAPER (with combination holder and cutter)
- *a*) 18 in.
- *b*) 38 in., upright, to be used with cylinder press only

TYPE
- *a*) Body, lightface — 8 and 10 pt.
- *b*) Job, lightface — 6, 8, 10, 12, 14, 18, 24, 30, 36, and 48 pt.
- *c*) Job, lightface italics — 8, 10, 12, 14, 18, 24, and 36 pt.
- *d*) Job, boldface — 6 and 8 pt.; 12 pt., No. 26; 12 pt., No. 27; 12 pt., No. 28; 18 pt., No. 30
- *e*) Job, light copperplate Gothic — 6 pt., Nos. 1, 2, 3, 4; 12 pt., Nos. 5, 6, 7, 8
- *f*) Job, condensed title Gothic — 12, 18, 24, 36, 48, 60, and 72 pt.
- *g*) Job, text type — 10, 12, 14, 18, and 24 pt.
- *h*) Job, typewriter type — 12 pt. with spaces
- *j*) Job, boldface italic — 8, 10, 12, 14, 18, 24, 30, and 36 pt.
- *k*) Job, heavy copperplate Gothic

(Continued on page 80A)

PERSONAL NEWS

(Continued from page 63A)

City, Kans., Public Schools; was assistant director of Aircraft Ground Training School, Fairfax Airport, Kansas City, Kans.; taught at the Missouri Aviation Institute, U. S. Army Air Corps, Kansas City, Mo.; and joined the engineering faculty of the University of Kansas in 1941. In 1942 he was appointed assistant professor and head of the department of shop practice. He holds a B.S. degree from Kansas State Teachers College, Pittsburg, Kans.; an A.M. degree from the University of Missouri; and has had technical and graduate work at Iowa State College and at General Motors Institute of Technology, Flint, Mich.

♦ ALLYN C. TAYLOR, former co-ordinator and director of war-production training at St. Paul, Minn., was appointed principal of the Vocational School, according to an announcement made by B. H. Brynildsen, city director of vocational education.

♦ A. A. KVORNING, former supervisor of war-production training at St. Paul, Minn., is now director of all war-production training.

♦ CHRIS BREIVIK, assistant to Mr. Ersche in the cabinet shop of the Vocational School, St. Paul, Minn., for many years, was transferred to the position of grade manual training instructor at the beginning of this school year.

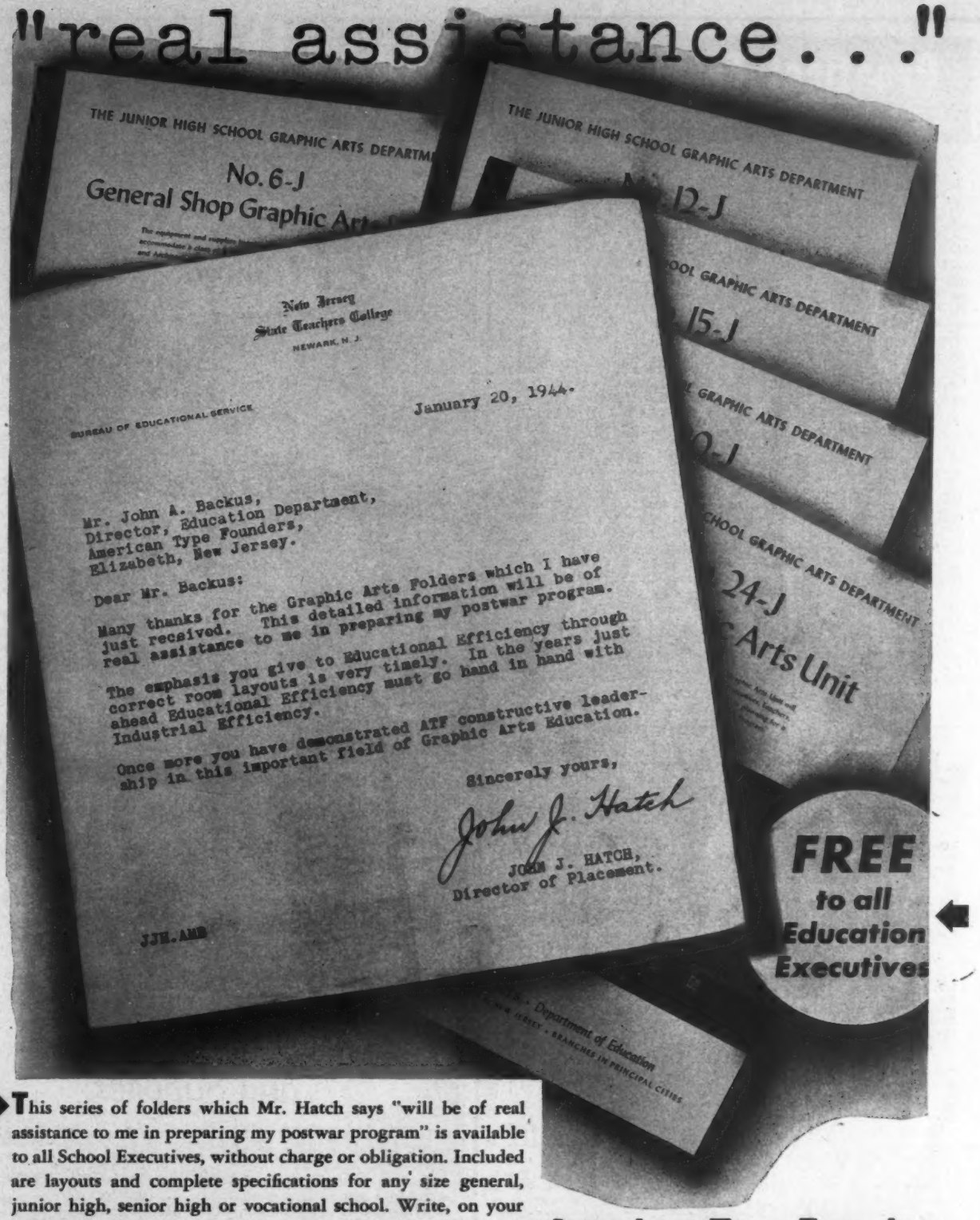
Mr. Breivik, a veteran of World War I, first came to Vocational School as a student under the national rehabilitation act providing training for disabled ex-servicemen. After completing his course in cabinetmaking, he remained to assist Mr. Ersche with instruction in that shop.

♦ DEWEY FORCIEA, who has been actively engaged in sheet-metal work for more than 32 years, was chosen as sheet-metal shop instructor at the Vocational School, St. Paul, Minn., to replace E. S. Donaldson, who retired last June.

At the present time, Mr. Forciea is president of the local sheet-metal workers union.

♦ JAMES F. ROACH took charge of the electric shop at the Vocational School, St. Paul, Minn. Mr. Roach has had a wide experience in the electric trade which extends over a period of approximately 32 years.

"real assistance..."


THE JUNIOR HIGH SCHOOL GRAPHIC ARTS DEPARTMENT
No. 6-J
General Shop Graphic Art
THE JUNIOR HIGH SCHOOL GRAPHIC ARTS DEPARTMENT
12-J
15-J
24-J
Arts Unit
New Jersey
State Teachers College
NEWARK, N. J.
BUREAU OF EDUCATIONAL SERVICE
January 20, 1944.
Mr. John A. Backus,
Director, Education Department,
American Type Founders,
Elizabeth, New Jersey.
Dear Mr. Backus:
Many thanks for the Graphic Arts Folders which I have just received. This detailed information will be of real assistance to me in preparing my postwar program.
The emphasis you give to Educational Efficiency through correct room layouts is very timely. In the years just ahead Educational Efficiency must go hand in hand with Industrial Efficiency.
Once more you have demonstrated ATF constructive leadership in this important field of Graphic Arts Education.
Sincerely yours,
John J. Hatch
JOHN J. HATCH,
Director of Placement.
JJH.AMB
FREE
to all
Education
Executives
Department of Education
BRANCHES IN PRINCIPAL CITIES

This series of folders which Mr. Hatch says "will be of real assistance to me in preparing my postwar program" is available to all School Executives, without charge or obligation. Included are layouts and complete specifications for any size general, junior high, senior high or vocational school. Write, on your school stationery, for free copies of any of these folders, mentioning type of school and size of class to be accommodated.

American Type Founders

Department of Education · 200 Elmora Avenue · Elizabeth B, N. J.

Branches and Dealers in Principal Cities

Practical Textbooks

Examine Them on APPROVAL

These modern texts have been especially prepared for school use. You can employ them to excellent advantage in your War Training and regular programs, as well as your rehabilitation work. An examination will convince you of their suitability to your classroom needs. Any books sent for 30 days ON APPROVAL inspection subject to our educational discount if retained.

SLIDE RULE SIMPLIFIED

HARRIS. 266 pp., well illustrated. Washable cloth binding. A real "how-to-do-it" book written in a practical and easy-to-understand manner. The book is divided into two sections so it can be used both by those who have never before handled a slide rule and also by those who are familiar with it but want to become more proficient. It is beautifully illustrated with special line drawings which greatly aid in making the book easy to learn from. The book comes boxed with a high-grade Dietzgen Slide Rule for those who do not already have a rule. For those who do have one, the book is available by itself. Contains review questions and problems at end of each chapter, with answers.

Price of book with rule $3.50
Price of book alone $2.50

PRE-INDUCTION TEXTS

We have co-operated with the U. S. Office of Education and the Pre-Induction Training Center of the War Department by publishing the following 4 texts and workbooks. We have closely followed the outlines given us by the Office of Education and the War Department. The texts are up-to-date, clearly written, splendidly illustrated and durably and handsomely bound in cloth. The workbooks follow our own practical 6-step plan of training. They are especially valuable because of the teacher shortage, for even an instructor with very little experience in these fields can, by using the workbooks and keeping a lesson or two ahead of the class, do an efficient job of instructing. The workbooks are bound in heavy paper with plastic spirals so as to lay flat on the desks for easy handling, and the texts are bound in handsome and durable cloth to give long service. The books are not only ideally adapted for use in school classrooms but also by individuals for home study work.

FUNDAMENTALS OF ELECTRICITY: McDougal-Dunlap-Ransom. 588 pages, 310 illus. $2.00
Workbook $0.50
FUNDAMENTALS OF MACHINES: Hobbs-Kuns-Morrison. 294 pages, 227 illus. $2.00
Workbook $0.50
FUNDAMENTALS OF RADIO: Gorder-Hathaway-Dunlap. 373 pages, 230 illus. $2.00
Workbook $0.50
FUNDAMENTAL SHOP TRAINING: Shuman-Monroe-Wright. 350 pages, 288 illus. $2.00
Workbook $0.50

PLASTICS

DUBOIS. 435 pp., 203 illus. (2 pages in 4 colors), 50 tables. Cloth binding. 2nd revised and enlarged edition. The first edition came from the press only a few months ago and went through three printings. Due to the war, development in the plastic field has been tremendous and so we have revised and enlarged the book, by nearly 150 pages, to include these new developments. There is an entirely new section on all types of synthetic rubber, another on low-pressure laminating, etc. It is more than ever a practical book for actual users of plastics who need basic information on these materials, and for those interested in the subject with the idea of going into the field or using plastics in connection with their products. Price $3.75

PLANE TRIGONOMETRY MADE PLAIN

CARSON. 389 pp., 198 illus. Cloth binding. There is a huge demand for men with a knowledge of "trig" and we believe this is the most practical and easy-to-understand book ever written on the subject. Emphasis is placed on the application of trigonometric principles in the solution of everyday problems. Price $2.75
Answer book $0.25

HOW TO READ ELECTRICAL BLUEPRINTS

HEINE-DUNLAP. 318 pp., 301 illus. 9 full sized blue-prints drawn to scale. Cloth binding. A practical "how-to-do-it" book explaining how to read blueprints for eight branches of the electrical field. Pages of symbol drawings have been prepared in which, opposite each symbol, is shown a picture of the object the symbol represents. Contains over 200 questions and answers. Price $3.00

(TEAR OFF HERE AND MAIL TO US)

AMERICAN TECHNICAL SOCIETY
Drexel Ave., at 58th St., Chicago 37, Ill., Dept. HS — 182
Please send the following texts for 30 days ON APPROVAL examination. I will either return them at the end of that time or remit less your educational discount.

Name _____
School _____
School Address _____

Detroit Public Library

(Continued from page 78A)

—6 pt., Nos. 21, 22, 23, and 24; 12 pt., No. 25
l) Wood, condensed Gothic—8, 12, 15, and 18 line
m) 10 pt. line leaders, 4 dots to the em
n) 10 pt. braces and dashes
o) 10 pt. fractions
p) 10 pt. references
q) Parentheses and brackets
r) 2 pt. laborsaving leads, 4 to 25 picas
s) 6 pt. laborsaving slugs, 4 to 25 picas
t) 2 pt. laborsaving brass rule
u) 2 pt. miters for rule
v) Laborsaving metal furniture
w) Thin spaces with quarter-size case

TYPESETTING MACHINES
a) Either linotype or intertype, 2 or 3 magazines, and molds
b) Matrices for same, 6, 8, 10, and 12 point, as selected

VISUAL AID CHARTS

Print-Shop Supplies

BENZINE OR GASOLINE—for cleaning type or presses

BINDERY TAPE—2 in. wide, brown or black

GOLD BRONZE—pale

INK
a) Bond, black, for bond papers
b) Book, black, for school papers, etc.
c) Cover, colors as selected
d) Dryers and compounds, as selected
e) Half tone, black
f) Job, colors as selected
g) Metallic, gold and silver
h) Process, black, red, yellow, blue

KEROSINE—for cleaning rollers

PADDING CEMENT
a) Cold
b) Hot

PAPER
a) Bond, fine grade, 17 by 22—20, white
b) Bond, medium grade, 17 by 22—20, white
c) Bond, sulphite, 17 by 22—20, white
d) Bond, sulphite, 17 by 22—20, colors as selected
e) Book, enamel, 25 by 38—80, white
f) Book, machine finish, 25 by 38—80, white
g) Book, eggshell finish, 25 by 38—60, white
h) Cover, as selected, 20 by 26, medium
i) Card Bristol, fine grade, 22 by 28—4 ply, white
k) Index Bristol, medium grade, 25½ by 30½—110, white
l) Index Bristol, medium grade, 25½ by 30½—140, white
m) Mill Bristol, medium grade, 25½ by 30½—140, colors as selected
n) Pressboard, red
o) Strawboard, No. 40 or No. 50
p) Tagboard, manila, 24 by 36—140
q) Tympan, to fit presses
r) Wrapping paper, size as selected
s) Holder for same

PASTE
a) Bindery
b) Make ready

SILK-SCREEN SUPPLIES consisting of:
a) Silk-screen process paste paint, 1 each of the following colors: toluidine red, strontian yellow, ultramarine blue, medium green, rich brown, orange, purple, white, and black
b) Solvent profilm in 11- by 14-in. sheets
c) 8-in. synthetic squeegee
d) 11-in. synthetic squeegee
e) No-clog varnish
f) Film solvent
g) Stencil filler
h) Filler remover
i) Stencil knife
k) Fiber guides
l) Red sable brush—½ in.
m) Putty knife
n) Frame tape

TWINE—cotton, for tying jobs

WIRE STITCHING
a) No. 28 round wire for stitcher
b) Wire staples, ¼ in.

Drafting Equipment and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

ADJUSTABLE-CURVE RULER

BEAM COMPASS

BENCH BRUSHES

BLACKBOARD
a) Permanent or portable
b) Compass, 15 in., with locking device
c) Drawing set: T square, straightedge, triangle, and protractor

BLUEPRINT
a) Frame or machine
b) Washing trays or washer
c) Paper tube, airtight
d) Drying rack or dryer

BOOKCASE

CABINET
a) For filing drawings

(Continued on page 82A)

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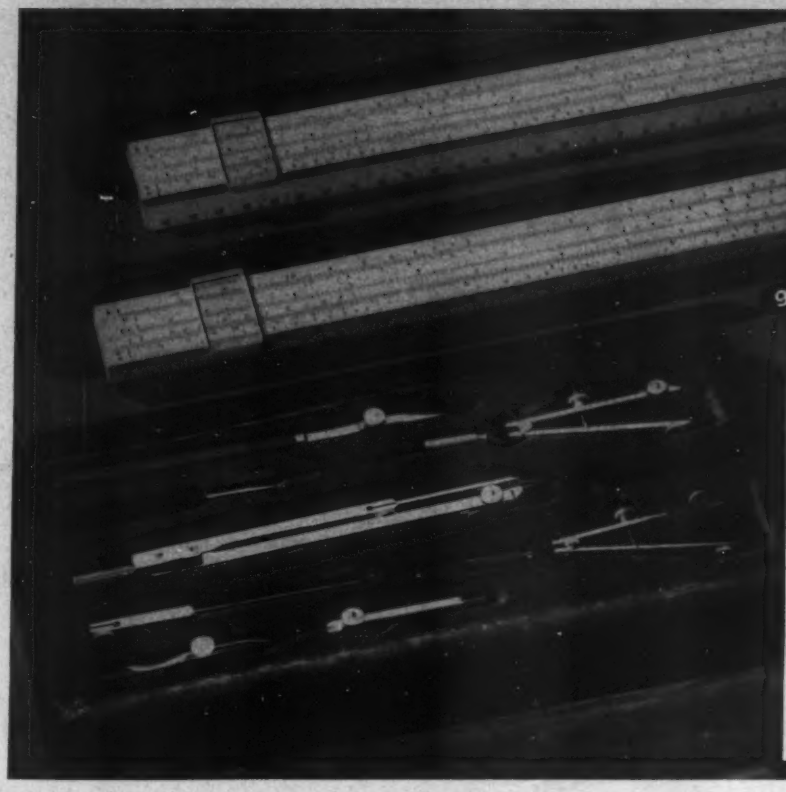

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(Continued from page 80A)

b) For storing drawing boards
c) For storing drawing instruments
d) For storing models

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DESK — teacher's
DIVIDERS — proportional
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MICROMETER — 1 in., for mechanical-drafting students
OILSTONE — 3-in. case
PANTOGRAPH — 21 in.
PARALLEL RULES
PLANIMETERS
PLUMB BOB
SHEARS — for trimming blueprints and drawings
SPEED COUNTER — for mechanical-drafting students
STEEL SCALES — 12 in.
STOP WATCH — for mechanical-drafting students
TABLE
a) For cutting and trimming drawings and blueprints
b) For disassembling and reassembling machine parts and models
TAPELINE
a) 100 ft., steel, for architectural students
b) 50 ft., steel or metallic
TOOLBOX — containing 1 machinists' hammer, one 6-in. adjustable wrench, one 6-in. screw driver, one 6-in. combination pliers
TRIANGLES
a) 30–60 deg., 14 in. transparent
b) 45 deg., 10 in. transparent
TRIANGULAR SCALES — civil engineers' type, 12 in.
T SQUARE — adjustable or fixed head, for large drawing board or straightedge with parallel rule attachment for large drawing boards
WALL CHARTS — lettering, decimal equivalents, etc.
YARDSTICK

To be provided by, or for, each student

Drafting—Small Equipment

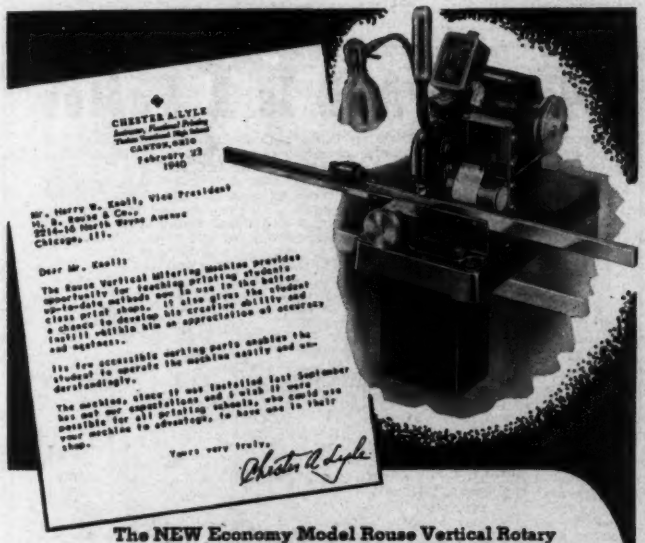
DRAWING BOARD — size to be specified by instructor
DRAWING INSTRUMENTS — as specified by instructor
ERASING SHIELD
IRREGULAR CURVE — Nos. 8 and 13, transparent
PENCIL COMPASS
PENHOLDER — for lettering pens
PENS — assorted, for lettering
PROTRACTOR — not over 5 in.
SCALE — 12 in. architects', triangular
SCALE GUARD
SLIDE RULE — 10 in., as specified by instructor
T SQUARE — to fit drawing board
TRIANGLES — 30–60 deg., 10 in. transparent, and 45 deg., 8 in. transparent

Drafting Supplies

BICHROMATE OF POTASH — crystals
BLUEPRINT
a) Paper, 36 in. wide
b) Writing fluid
PAPER
a) Cross section, 8½ by 11 in.
b) Detail, 24 by 36 in.
c) Drawing, 24 by 36 in.
d) Isometric, 7 by 10 in.
e) Tracing, 36 in.
POWDER — for tracing cloth
TRACING CLOTH — 36 in.
VAN DYKE
a) Fixing salts
b) Paper, 36 in.
c) Writing fluid

Drafting—Additional Supplies

To be provided by, or for, each student
ERASERS
a) Cleaning
b) Ink
c) Pencil
INK
a) Black, waterproof
b) Colored, if required
PENCILS — DRAWING, HB, 2H, 3H, 4H, and 6H
PENCIL POINTER PAD
THUMBTACKS OR SCOTCH TAPE



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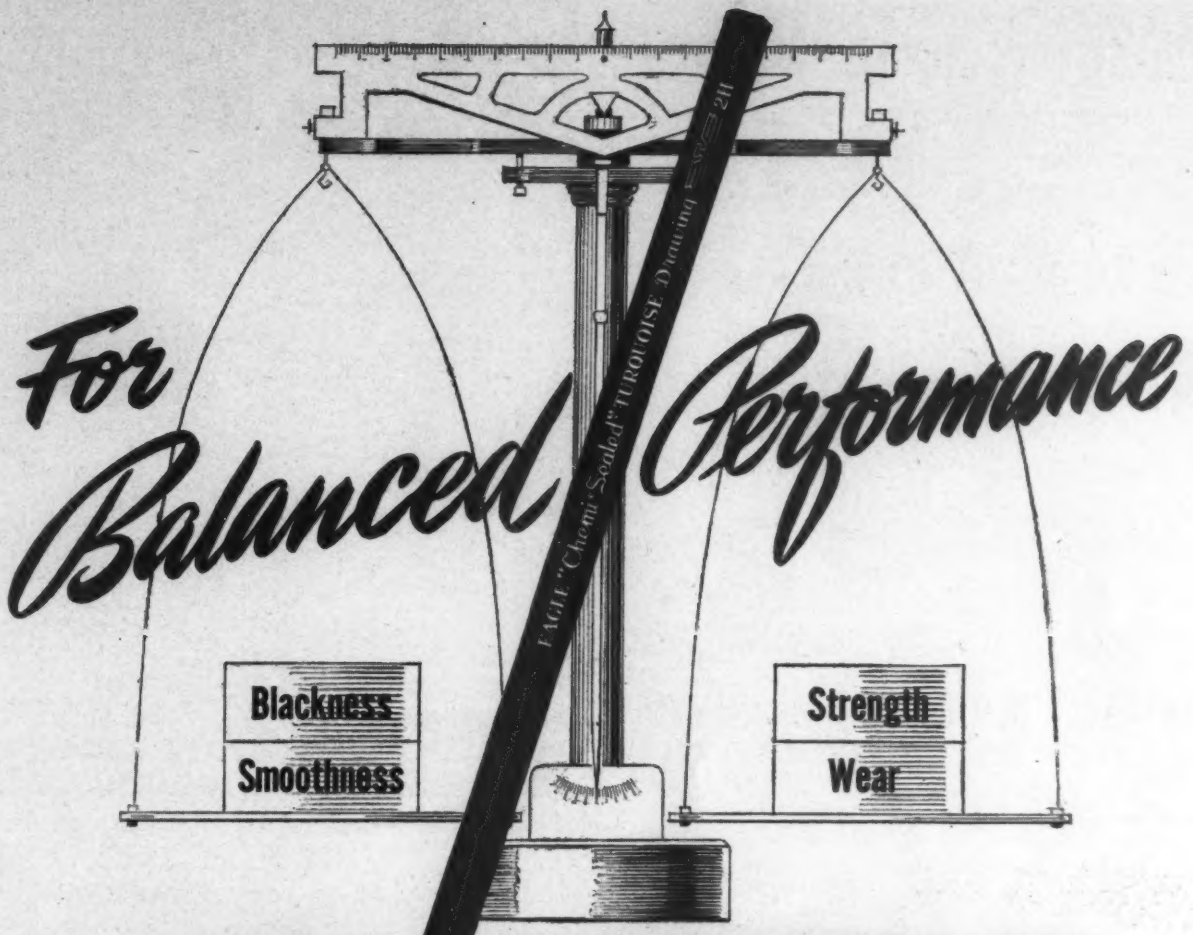

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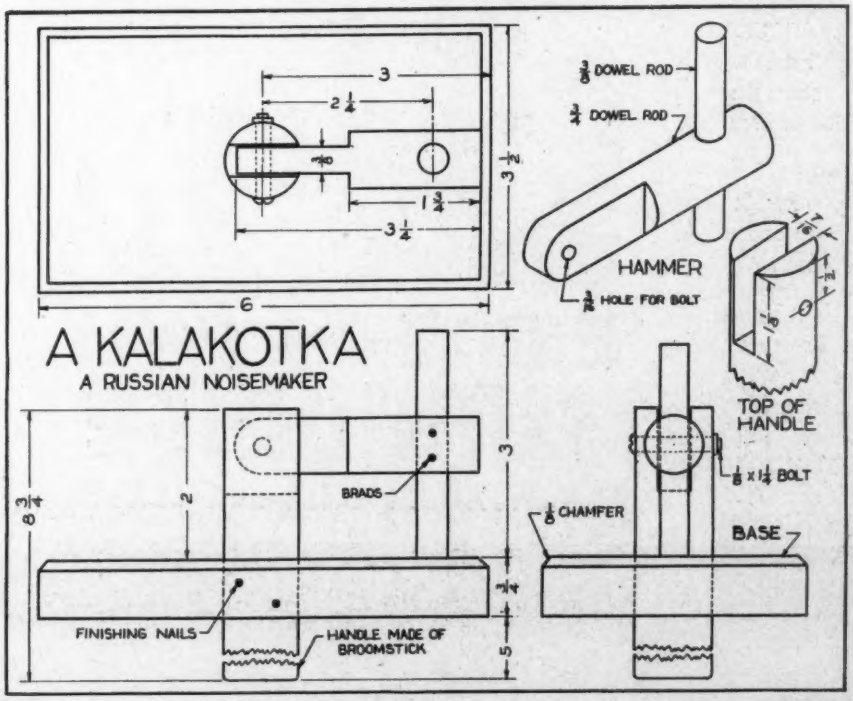

NEWS NOTES

(Continued from page 73A)

Information concerning the new silhouette slides or the complete Aircraft Identification Kit may be obtained by writing to Society for Visual Education, Inc., 100 East Ohio St., Chicago 11, Ill.

♦ During the past several weeks, Job Instructor Training has been conducted for five groups of foremen in Pittsburg and six groups of foremen in Coffeyville, Kans. Prof. Wm. H. Matthews, Pittsburg, and W. F. Currier, Coffeyville, organized these groups. The training was handled by Mr. Beaty and Mr. Meyer.

♦ A Cooperative Part-time Office Training Program has been established at the Coffeyville Junior College, Coffeyville, Kans.

♦ A comprehensive practical manual on industrial salvage has just been published by the Technical Service Section, Industrial Salvage Branch, Salvage Division, War Production Board, and is now being distributed to industry.

The new book, entitled *Salvage Manual for Industry*, contains 245 pages of systematically organized and classified information and data on industrial salvage practice in all of its ramifications. The material is presented in 26 chapters, and grouped into 6 major sections.

A copy of this paper-bound, 6 by 9-in., 250-page book may be obtained from the Superintendent of Documents, Washington, D. C. Price, 50 cents.

♦ The Pennsylvania State College is sponsoring 10 teacher-training classes at the Pennsylvania State School of Aeronautics, Harrisburg. Robert T. Stoner is the principal. Other classes are being given at Williamsport, Scranton, Wilkes-Barre, Hershey, Olmstead Field, and Lewistown, Pa.

♦ Some interesting units on the history of our flag and the Marine Corps may be obtained free by writing to Capt. W. F. Cook, U.S.M.C.R., United States Marine Corps, Quartermaster's Depot, Philadelphia, Pa.

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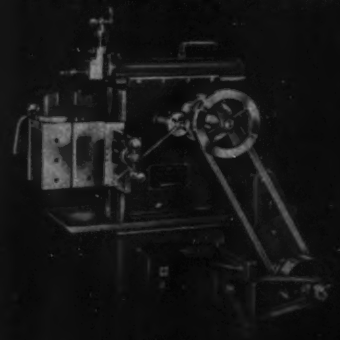

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(Continued from page 76A)

Elements of Topographic Drawing

By R. C. Sloane and J. M. Montz. Cloth, 251 pages, 9 by 5⅞ in., illustrated. Price, $3. The McGraw-Hill Book Co., New York City.

This is the second edition of this book in which symbols and methods used in topographic drawing have been revised to conform to present practices.

The nine chapters of the book cover field and office work and show many types of topographic illustration both in black on white and in colors.

Elementary Rivet Theory

By Blommel, Wheatley, and Johnson. Paper, 57 pages, 6⅝ by 9 in., illustrated. Price, $1. D. Van Nostrand Co., Inc., New York, N. Y.

A brief course for the beginning riveter, covering the safety, measuring, layout, drilling, and riveting procedures which the aircraft riveter must master.

Theory and Practice of Arc Welding

By Raymond J. Sacks. Cloth, 383 pages, 6⅞ by 9¾ in. Price, $2.80. D. Van Nostrand Co., New York, N. Y.

A comprehensive explanation of where and how arc welding is used, what kind of equipment is needed, the types of electrodes that are required, how the many different kinds of welds are made, the nature of iron and steel, how welds are tested, the flame cutting of metals, and safety precautions that must be observed while welding or cutting.

The book also explains how to read blueprints, and how to interpret welding symbols. Fifty-eight lessons are outlined for the student and tests and questions for the various jobs have also been set up.

Besides the foregoing, the book contains a chapter on definitions of welding terms.

Accounting and Control Manual

Paper covered, 45 pages, 8½ by 11 in. Prepared by the Cooper-Bessemer Corp., Mount Vernon, Ohio, and Grove City, Pa.

Originally intended to acquaint the employees of this old firm (110 years), with the various departmental functions, this booklet is now published to make this data generally available.

It describes the firm's product; machine shop, foundry, and assembly floor operations; the controls governing materials, purchasing, operations, inspection, scrap, production, employees, pay roll, costs, inventories, accounting, and the like.

The booklet also contains a glossary of office and products terms.

A Preliminary Study of Adult Education in British Columbia, 1941

Prepared by a Special Committee of the Public Library Commission, Victoria, B.C., Canada. Paper covered, 77 pages, 8⅛ by 10⅝ in.

This report contains an analysis of the provincial, dominion, and informal agencies in the field of adult education, and the legal considerations involved.

In the summary, attention is called to the value of the radio service and suggestions are given on how to make it more useful. The report also points out the need of co-ordinating and correlating the many agencies now operating in this field.

The recommendations suggest accordingly that this co-ordinating authority be vested in the Provincial Department of Education, and that legislation be enacted for calling into life a division of the Department of Education, specially concerned with adult education. Further, that a director be appointed for this division who is to be assisted by a special council of adult education, in the laying down of policies for guidance in conducting this work.

Student Workbook for International Code Study

By Victor J. Smith. Paper, 52 pages, 5¾ by 8⅝ in. Price, 15 cents. Published by the Technical Press, El Paso, Tex.

This workbook is to accompany the text "Receiving the International Morse Code" by the same author.

Successful Soldering

By Louie S. Taylor. Cloth, 76 pages, 4⅞ by 7½ in., illustrated. Price, $1. The McGraw-Hill Book Co., New York City.

A concise exposition of how to solder, what solders to use, and what methods to pursue to make well-soldered joints on various kinds of metal.

Hand Tools

By Albert M. Wagener and Harlan R. Arthur. Cloth, 174 pages, 5½ by 8½ in., illustrated. Price, $1.75. D. Van Nostrand Co., Inc., New York, N. Y.

A guide for the beginning shopworkers through the maze of measuring tools; hand shaping, forming, and marking tools; turning, gripping, and holding tools; hole forming tools; machine cutters; and miscellaneous tools.

Creative Art Crafts

By Pedro de Lemos. Cloth, 88 pages, 9⅜ by 12¼ in., illustrated. Price, $3.75. The Davis Press, Inc., 44 Portland St., Worcester, Mass.

This book is filled with projects for the teen-age pupil interested in paper craft, toy craft, or relief craft.

There are 43 illustrations in color, and 78 full pages of interest arousing illustrations.

So You Want to Be a Chemist

By Herbert Coith. Cloth, 128 pages, 5⅛ by 7¾ in. The McGraw-Hill Book Co., New York City.

This book, written by the chemical director of a large industrial firm, gives the vocational adviser and the seeker after vocational information, firsthand factual pointers on what industry asks of those who want to work in its chemical research laboratories.

Basic Problems in Engineering Drawing

By William W. Turner. 8½ by 11 in. Price, $1.25. The Ronald Press Co., New York, N. Y.

(Continued on page 88A)

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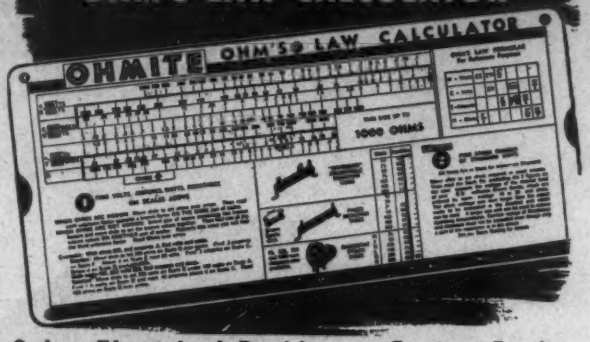

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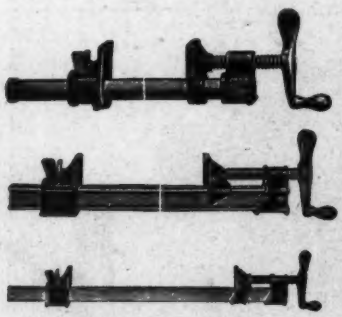

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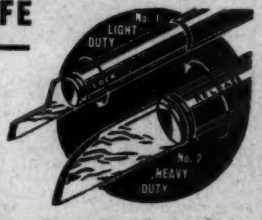

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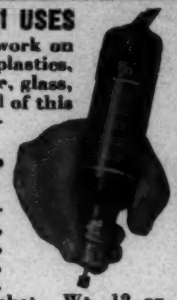

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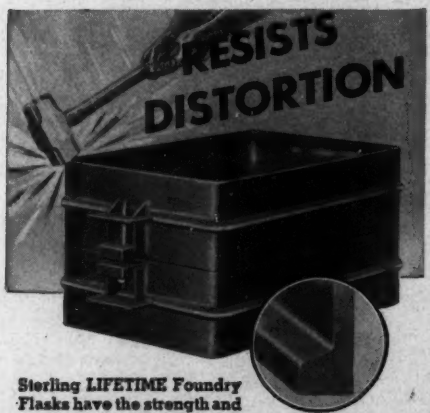

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(Continued from page 88A)

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By M. G. Suffern. Cloth, 271 pages, 5⅝ by 8¼ in., illustrated. Price, $2.25. The McGraw-Hill Book Co., New York City.

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By Orlo M. Schultz. Published by Florida Curriculum Laboratory, University of Florida, Gainesville, Fla.

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These books may be bought from the Project in Applied Economics, College of Education, University of Florida, Gainesville, Fla.

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By J. Robert Hall. Cloth, 188 pages, 8¼ by 11¼ in., illustrated. Price, $3. The McGraw-Hill Book Co., New York City.

This book, as its title indicates, gives the student very practical instructions on how to make the many different kinds of patterns which the industrial patternmaker is called upon to produce.

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By William J. Micheels, Chief Personnel Training Section. Paper, 43 pages, 8 by 10½ in. Published by the Office of Defense Transportation, Washington, D. C.

The first issue of a bulletin describing some of the training practices now in use in training the personnel of the various branches of transportation, such as railroads, trucking, automotive maintenance, and air lines.

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Compiled and edited by Richard B. Starr. Cloth, 191 pages, 5⅜ by 7½ in. Price, $2. Published by Prentice-Hall, Inc., New York, N. Y.

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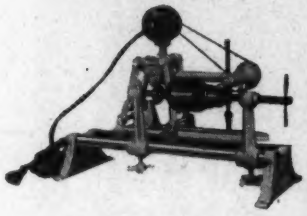

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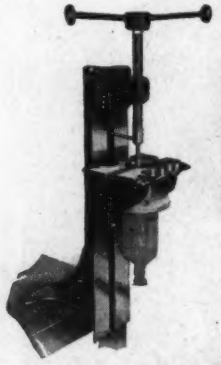

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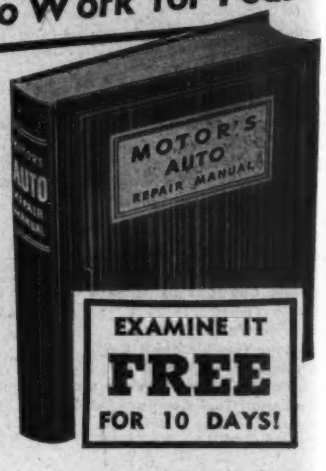

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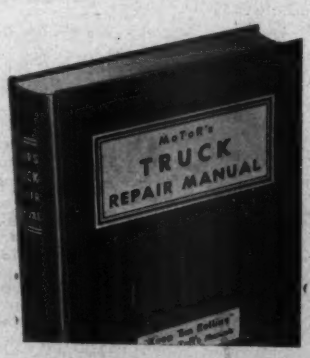

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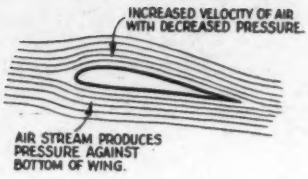

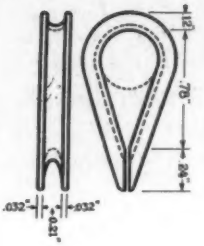

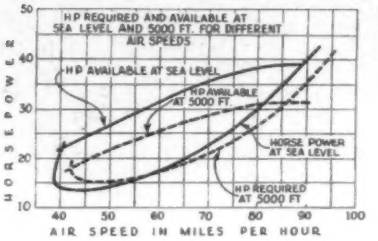
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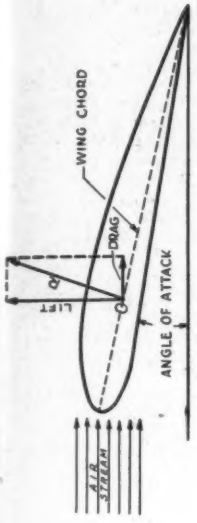
H.P REQUIRED AT 5000 FT.
HORSEPOWER
AIR SPEED IN MILES PER HOUR



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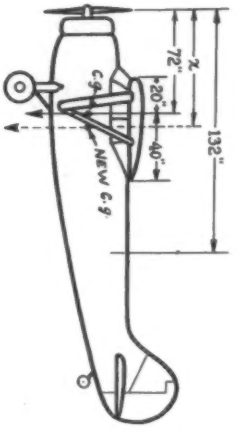

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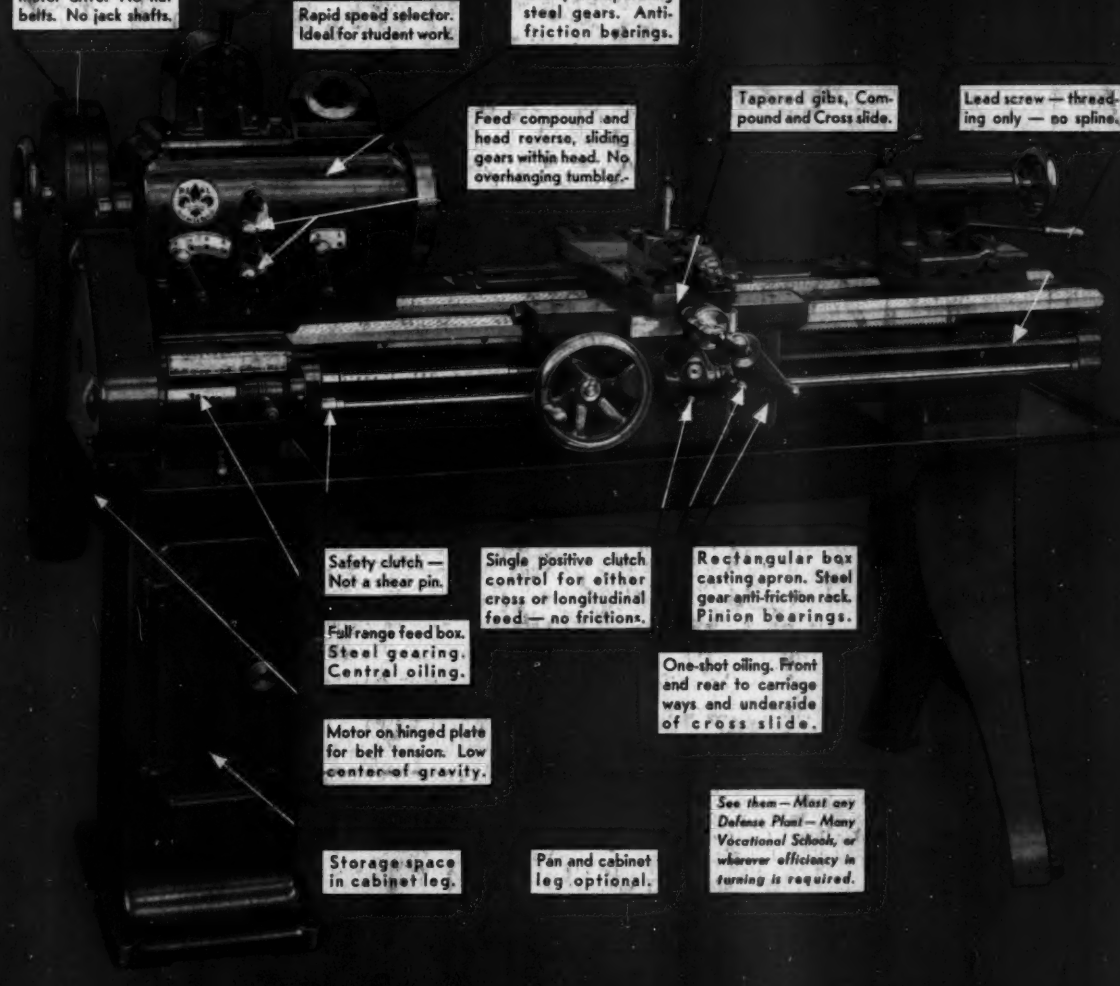
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